

August 2013

New Products Catalog

High Performance Analog ICs



LTC2057 High Voltage, Low Noise Zero-Drift Operational Amplifier

LTC3330 Nanopower Buck-Boost + DC/DC with Energy Harvesting
Battery Life Extender

LT4320 Ideal Diode Bridge Controller

LT3081 1.5A Single Resistor Rugged Linear Regulator with Monitors

LTM4637 20A DC/DC μ Module Step-Down Regulator

LTC3774 Dual, Multiphase Current Mode Synchronous Controller
for Sub-Milliohm DCR Sensing

NEW!!!! Free Demo Boards Available!!!!

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Design Note

DN516 1 μ A I_Q Synchronous Boost Converter Extends Battery Life in Portable Devices	
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LTC2057/LTC2057HV

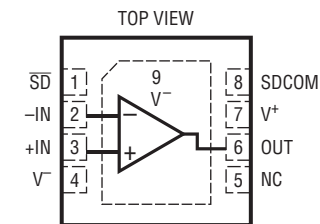
High Voltage, Low Noise Zero-Drift Operational Amplifier

FEATURES

- Supply Voltage Range
 - 4.75V to 36V (LTC2057)
 - 4.75V to 60V (LTC2057HV)
- Offset Voltage: 4 μ V (Maximum)
- Offset Voltage Drift: 0.015 μ V/ $^{\circ}$ C (Maximum, -40° C to 125° C)
- Input Noise Voltage
 - 200nV_{P-P}, DC to 10Hz (Typ)
 - 11nV/ $\sqrt{\text{Hz}}$, 1kHz (Typ)
- Input Common Mode Range: $V^- - 0.1\text{V}$ to $V^+ - 1.5\text{V}$
- Rail-to-Rail Output
- Unity Gain Stable
- Gain Bandwidth Product: 1.5MHz (Typ)
- Slew Rate: 0.45V/ μ s (Typ)
- A_{VOL}: 150dB (Typ)
- PSRR: 160dB (Typ)
- CMRR: 150dB (Typ)
- Shutdown Mode

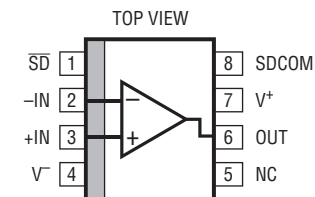
APPLICATIONS

- High Resolution Data Acquisition
- Reference Buffering
- Test and Measurement
- Electronic Scales
- Thermocouple Amplifiers
- Strain Gauges
- Low Side Current Sense
- Automotive Monitors and Control



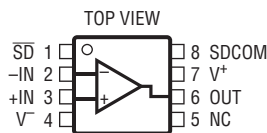
DD PACKAGE
8-LEAD (3mm x 3mm) PLASTIC DFN

LTC2057IDD
LTC2057HVIDD
LTC2057HDD
LTC2057HVHDD



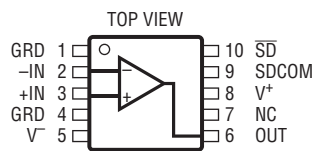
S8 PACKAGE
8-LEAD PLASTIC SO

LTC2057IS8
LTC2057HVIS8
LTC2057HS8
LTC2057HVHS8



MS8 PACKAGE
8-LEAD PLASTIC MSOP

LTC2057IMS8
LTC2057HVIMS8
LTC2057HMS8
LTC2057HVHMS8



MS PACKAGE
10-LEAD PLASTIC MSOP

LTC2057IMS
LTC2057HVIMS
LTC2057HMS
LTC2057HVHMS

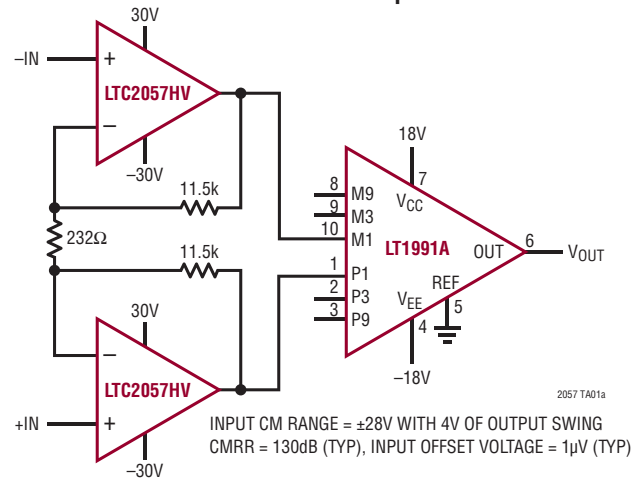
DESCRIPTION

The LTC[®]2057 is a high voltage, low noise, zero-drift operational amplifier that offers precision DC performance over a wide supply range of 4.75V to 36V or 4.75V to 60V for the LTC2057HV. Offset voltage and 1/f noise are suppressed, allowing this amplifier to achieve a maximum offset voltage of 4 μ V and a DC to 10Hz input noise voltage of 200nV_{P-P} (typ). The LTC2057's self-calibrating circuitry results in low offset voltage drift with temperature, 0.015 μ V/ $^{\circ}$ C (max), and zero-drift over time. The amplifier also features an excellent power supply rejection ratio (PSRR) of 160dB and a common mode rejection ratio (CMRR) of 150dB (typ).

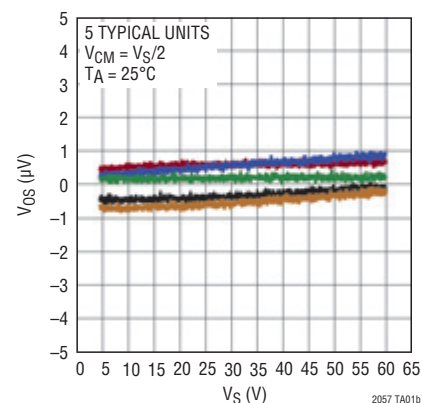
The LTC2057 provides rail-to-rail output swing and an input common mode range that includes the V^- rail ($V^- - 0.1\text{V}$ to $V^+ - 1.5\text{V}$). In addition to low offset and noise, this amplifier features a 1.5MHz (typ) gain-bandwidth product and a 0.45V/ μ s (typ) slew rate.

Wide supply range, combined with low noise, low offset, and excellent PSRR and CMRR make the LTC2057 and LTC2057HV well suited for high dynamic-range test, measurement and instrumentation systems.

Wide Input Range Precision Gain-of-100 Instrumentation Amplifier



Input Offset Voltage vs Supply Voltage



LT6015/LT6016/LT6017

3.2MHz, 0.8V/ μ s Low Power, Over-The-Top Precision Op Amps

FEATURES

- Input Common Mode Range: V^- to $V^- + 76V$
- Rail-to-Rail Input and Output
- Low Power: 315 μ A/Amplifier
- Operating Temperature Range: -55°C to 150°C
- V_{OS} : $\pm 50\mu\text{V}$ (Maximum)
- CMRR, PSRR: 126dB
- Reverse Battery Protection to 50V
- Gain Bandwidth Product: 3.2MHz
- Specified on 5V and $\pm 15V$ Supplies
- High Voltage Gain: 1000V/mV
- No Phase Reversal
- No Supply Sequencing Problems
- Single 5-Lead SOT-23 (ThinSOT™) Package
- Dual 8-Lead MSOP
- Quad 22-Lead DFN (6mm $\times$ 3mm)

APPLICATIONS

- High Side or Low Side Current Sensing
- Battery/Power Supply Monitoring
- 4mA to 20mA Transmitters
- High Voltage Data Acquisition
- Battery/Portable Instrumentation

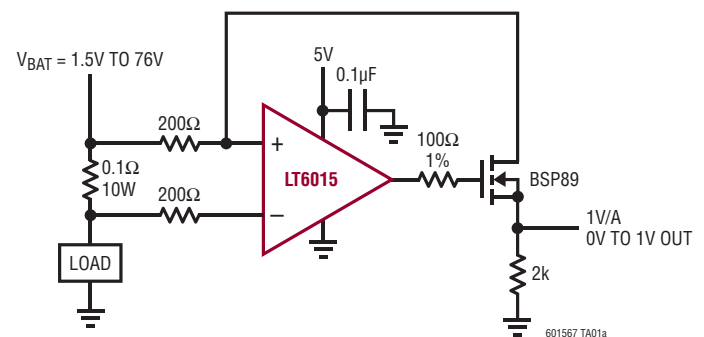
DESCRIPTION

The LT[®]6015/LT6016/LT6017 are single/dual/quad rail-to-rail input operational amplifiers with input offset voltage trimmed to less than 50 μ V. These amplifiers operate on single and split supplies with a total voltage of 3V to 50V and draw only 315 μ A per amplifier. They are reverse battery protected, drawing very little current for reverse supplies up to 50V.

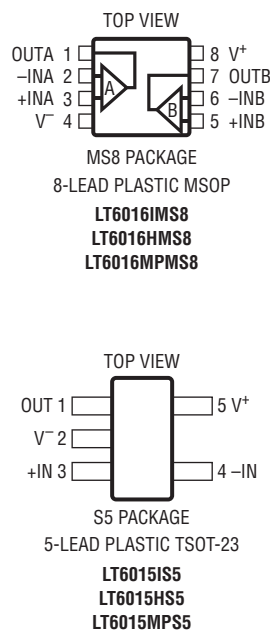
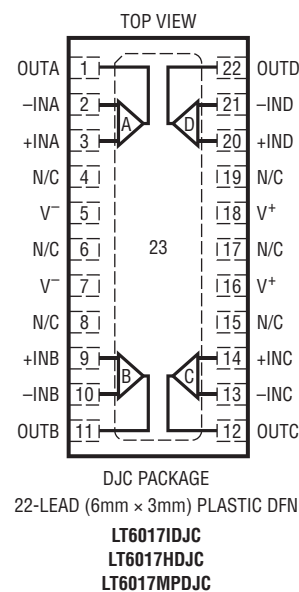
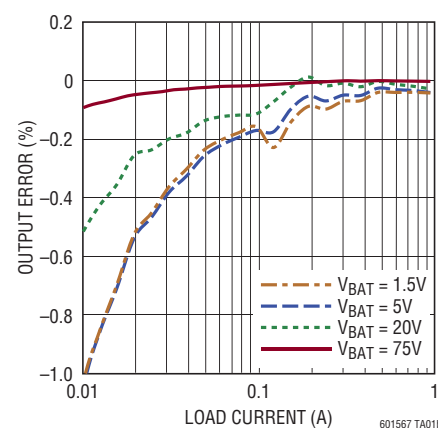
The Over-The-Top[®] input stage of the LT6015/LT6016/LT6017 is designed to provide added protection in tough environments. The input common mode range extends from V^- to V^+ and beyond: these amplifiers operate with inputs up to 76V above V^- independent of V^+ . Internal resistors protect the inputs against transient faults up to 25V below the negative supply. The LT6015/LT6016/LT6017 can drive loads up to 25mA and are unity-gain stable with capacitive loads as large as 200pF. Optional external compensation can be added to extend the capacitive drive capability beyond 200pF.

The LT6015 is offered in a 5-lead SOT package. The LT6016 dual op amp is available in an 8-lead MSOP package. The LT6017 is offered in a 22-pin leadless DFN package.

Precision High Voltage High Side Load Current Monitor



Output Error vs Load Current



LTC6804-1/LTC6804-2 Multicell Battery Monitors

FEATURES

- Measures Up to 12 Battery Cells in Series
- Stackable Architecture Supports 100s of Cells
- Built-In isoSPI™ Interface:
 - 1Mbps Isolated Serial Communications
 - Uses a Single Twisted Pair, Up to 100 Meters
 - Low EMI Susceptibility and Emissions
- 1.2mV Maximum Total Measurement Error
- 290µs to Measure All Cells in a System
- Synchronized Voltage and Current Measurement
- 16-Bit Delta-Sigma ADC with Frequency Programmable 3rd Order Noise Filter
- Engineered for ISO26262 Compliant Systems
- Passive Cell Balancing with Programmable Timer
- 5 General Purpose Digital I/O or Analog Inputs:
 - Temperature or other Sensor Inputs
 - Configurable as an I²C or SPI Master
- 4µA Sleep Mode Supply Current
- 48-Lead SSOP Package

APPLICATIONS

- Electric and Hybrid Electric Vehicles
- Backup Battery Systems
- Grid Energy Storage
- High Power Portable Equipment

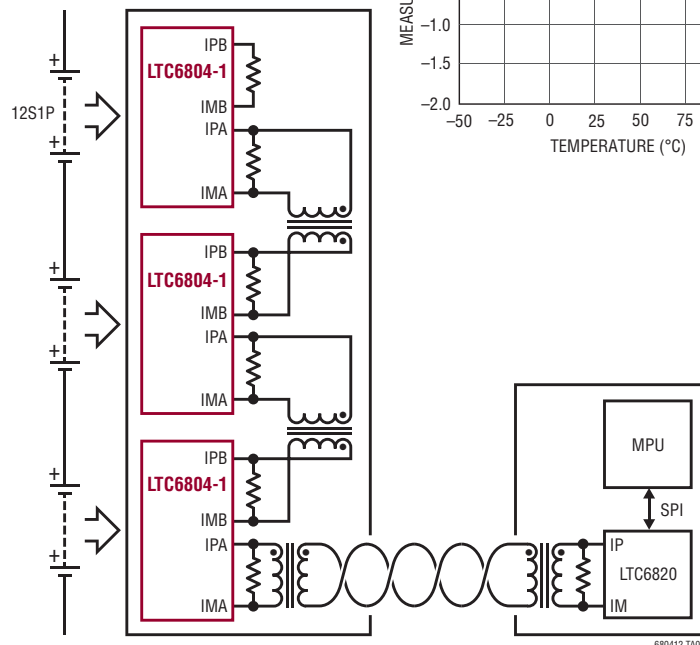
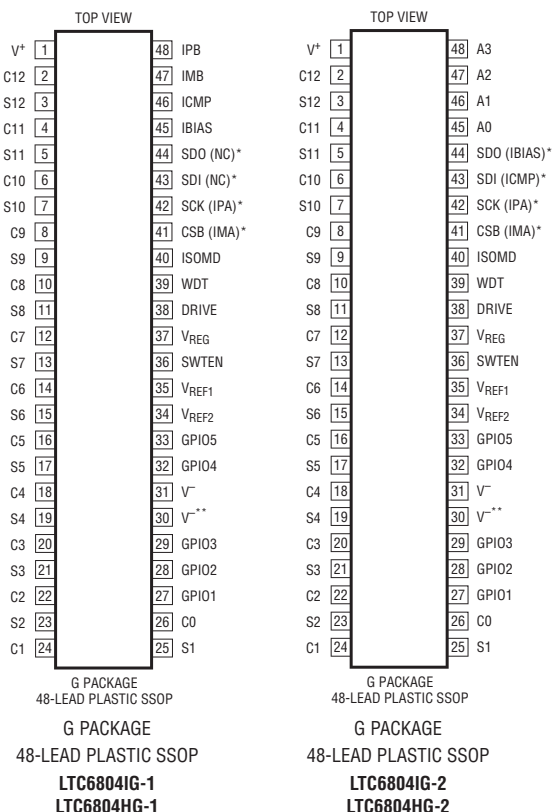
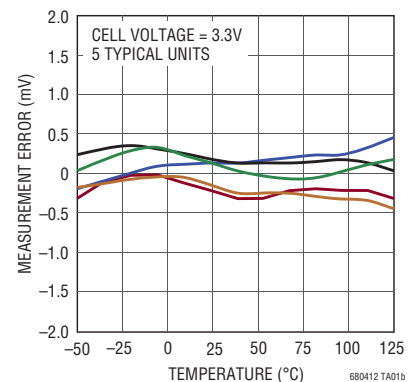
DESCRIPTION

The LTC®6804 is a 3rd generation multicell battery stack monitor that measures up to 12 series connected battery cells with a total measurement error of less than 1.2mV. The cell measurement range of 0V to 5V makes the LTC6804 suitable for most battery chemistries. All 12 cell voltages can be captured in 290µs, and lower data acquisition rates can be selected for high noise reduction.

Multiple LTC6804 devices can be connected in series, permitting simultaneous cell monitoring of long, high voltage battery strings. Each LTC6804 has an isoSPI interface for high speed, RF-immune, local area communications. Using the LTC6804-1, multiple devices are connected in a daisy-chain with one host processor connection for all devices. Using the LTC6804-2, multiple devices are connected in parallel to the host processor, with each device individually addressed.

Additional features include passive balancing for each cell, an onboard 5V regulator, and 5 general purpose I/O lines. In sleep mode, current consumption is reduced to 4µA. The LTC6804 can be powered directly from the battery, or from an isolated supply.

**Total Measurement Error
vs Temperature of 5 Typical Units**



LTC2313-12

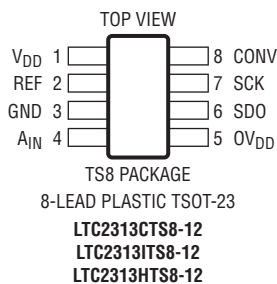
12-Bit, 2.5Msps Serial Sampling ADC in TSOT

FEATURES

- **2.5Msps Throughput Rate**
- **No Cycle Latency**
- **Guaranteed 12-Bit No Missing Codes**
- **Single 3V or 5V Supply**
- **Low Noise: 73dB SNR**
- **Low Power: 14mW at 2.5Msps and 3V Supply**
- **Low Drift (20ppm/°C Maximum) 2.048V or 4.096V Internal Reference**
- Sleep Mode with $< 1\mu\text{A}$ Typical Supply Current
- Nap Mode with Quick Wake-Up < 1 Conversion
- Separate 1.8V to 5V Digital I/O Supply
- High Speed SPI-Compatible Serial I/O
- Guaranteed Operation from -40°C to 125°C
- 8-Lead TSOT-23 Package

APPLICATIONS

- Communication Systems
- High Speed Data Acquisition
- Handheld Terminal Interface
- Medical Imaging
- Uninterrupted Power Supplies
- Battery Operated Systems
- Automotive

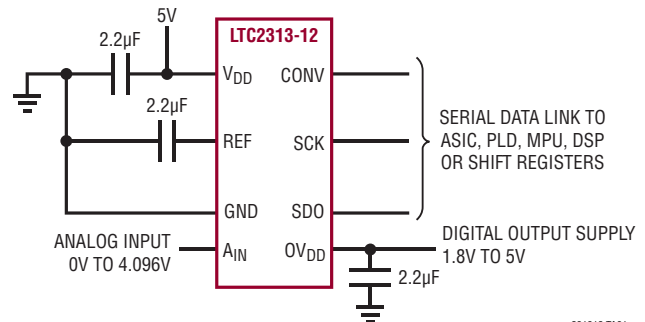


DESCRIPTION

The LTC[®]2313-12 is a 12-bit, 2.5Msps, serial sampling A/D converter that draws only 5mA from a single 3V or 5V supply. The LTC2313-12 contains an integrated low drift reference and reference buffer providing a low cost, high performance (20ppm/°C maximum) and space saving solution. The LTC2313-12 achieves outstanding AC performance of 72.6dB SINAD and -84dB THD while sampling at 2.5Msps. The extremely high sample rate-to-power ratio makes the LTC2313-12 ideal for compact, low power, high speed systems. The supply current decreases at lower sampling rates as the device automatically enters nap mode after conversions.

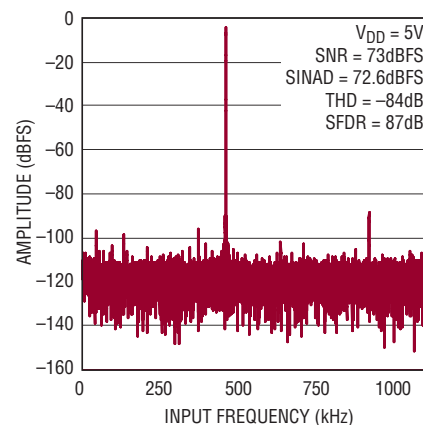
The LTC2313-12 has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3V and 5V logic. The fast 2.5Msps throughput with no cycle latency makes the LTC2313-12 ideally suited for a wide variety of high speed applications.

5V Supply, Internal Reference, 2.5Msps, 12-Bit Sampling ADC



231312 TA01a

$f_s = 2.5\text{Msps}$, $f_{IN} = 497\text{kHz}$ 16k-pt FFT



231312 TA01b

LTC2313-14

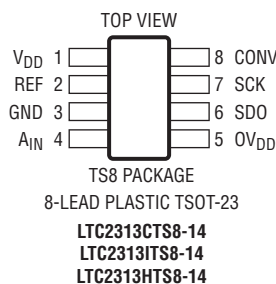
14-Bit, 2.5Msps Serial Sampling ADC in TSOT

FEATURES

- **2.5Msps Throughput Rate**
- **No Cycle Latency**
- **Guaranteed 14-Bit No Missing Codes**
- **Single 3V or 5V Supply**
- **Low Noise: 77.5dB SNR**
- **Low Power: 14mW at 2.5Msps and 3V Supply**
- **Low Drift (20ppm/°C Maximum) 2.048V or 4.096V Internal Reference**
- Sleep Mode with $< 1\mu\text{A}$ Typical Supply Current
- Nap Mode with Quick Wake-Up < 1 Conversion
- Separate 1.8V to 5V Digital I/O Supply
- High Speed SPI-Compatible Serial I/O
- Guaranteed Operation from -40°C to 125°C
- 8-Lead TSOT-23 Package

APPLICATIONS

- Communication Systems
- High Speed Data Acquisition
- Handheld Terminal Interface
- Medical Imaging
- Uninterrupted Power Supplies
- Battery Operated Systems
- Automotive

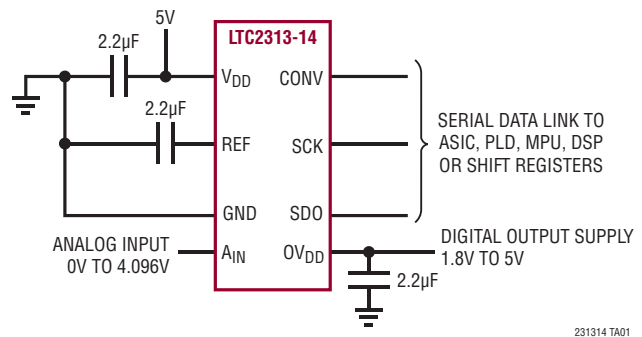


DESCRIPTION

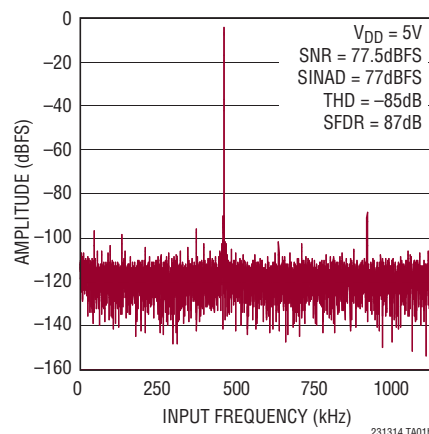
The LTC[®]2313-14 is a 14-bit, 2.5Msps, serial sampling A/D converter that draws only 5mA from a single 3V or 5V supply. The LTC2313-14 contains an integrated low drift reference and reference buffer providing a low cost, high performance (20ppm/°C maximum) and space saving solution. The LTC2313-14 achieves outstanding AC performance of 77dB SINAD and -85dB THD while sampling at 2.5Msps. The extremely high sample rate-to-power ratio makes the LTC2313-14 ideal for compact, low power, high speed systems. The supply current decreases at lower sampling rates as the device automatically enters nap mode after conversions.

The LTC2313-14 has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3V and 5V logic. The fast 2.5Msps throughput with no cycle latency makes the LTC2313-14 ideally suited for a wide variety of high speed applications.

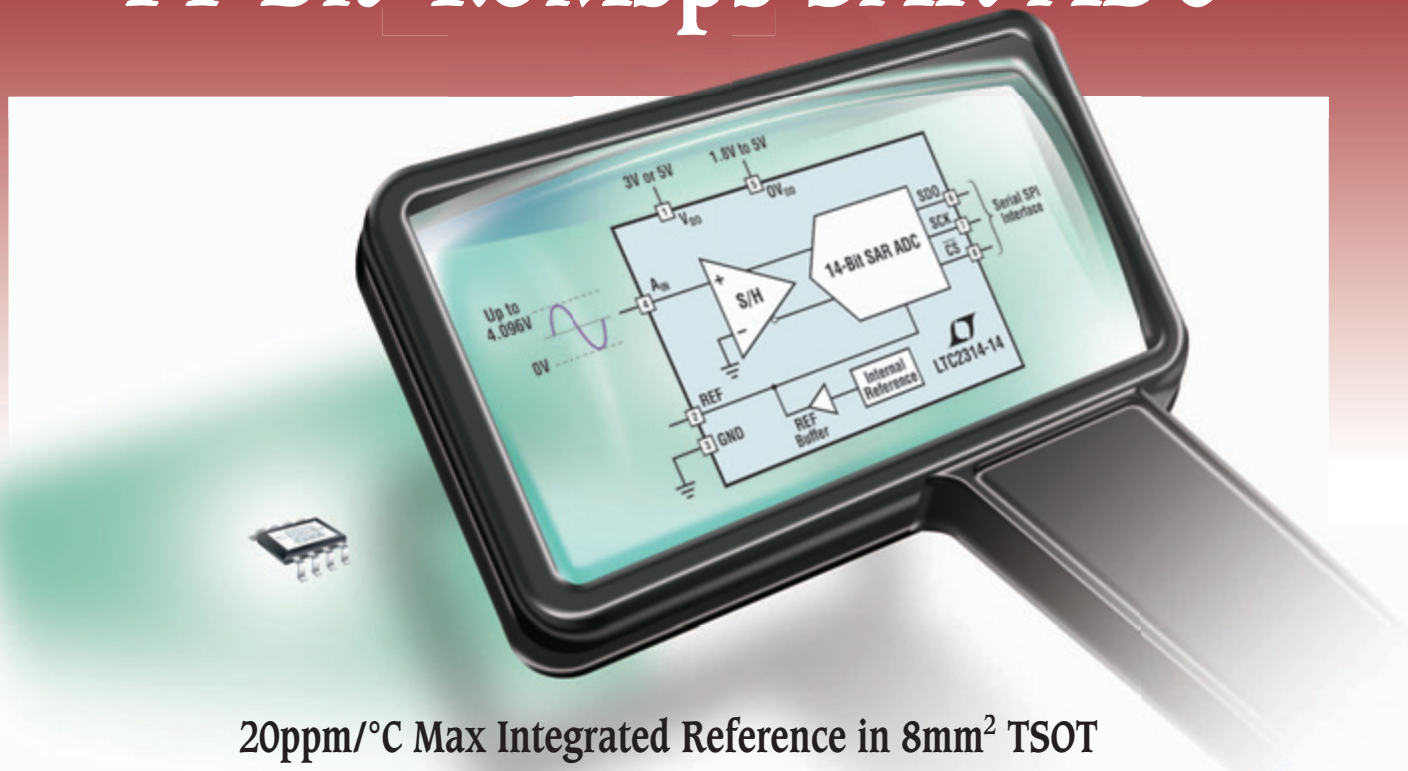
5V Supply, Internal Reference, 2.5Msps, 14-Bit Sampling ADC



16k Point FFT, $f_s = 2.5\text{Msps}$, $f_{IN} = 497\text{kHz}$



Tiny All-in-One 14-Bit 4.5Msps SAR ADC



20ppm/°C Max Integrated Reference in 8mm² TSOT

The LTC[®]2314-14 leads a family of highly integrated 14-/12-bit Successive Approximation Register (SAR) ADCs from 500ksps to 5Msps, available in tiny 8-lead TSOT-23 packages. These ADCs integrate a precision bandgap reference with guaranteed 20ppm/°C maximum temperature coefficient and an internal reference buffer in an 8mm² footprint, saving space in high density designs. They offer the flexibility of 3V or 5V supply operation and low power consumption, including nap and sleep modes.

▼ Features

- 4.5Msps Throughput Rate
- Low Noise: 77.5dB SNR, -85dB THD (5V Supply)
- $\pm 3.75\text{LSB INL}$, $\pm 0.99\text{LSB DNL Max}$ (5V Supply)
- Low Power: 31mW at 4.5Msps (5V Supply)
- Flexible 3V or 5V Supply Operation
- Internal Reference: 2.048V or 4.096V Span
- Guaranteed Operation -40°C to 125°C
- 8-Lead TSOT-23 Package

▼ Complete 14-Bit/12-Bit Pin-Compatible SAR ADC Family

	500ksps	2.5Msps	4.5Msps	5Msps
14-Bit	2312-14	2313-14	2314-14	
12-Bit	2312-12	2313-12		2315-12
Power Consumption 3V/5V	8mW/14mW	14mW/26mW	18mW/31mW	19mW/32mW

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Info & Free Samples
1-800-4-LINEAR
www.linear.com/LTC2314-14



LTC2376-20

20-Bit, 250ksps, Low Power SAR ADC
with 0.5ppm INL

FEATURES

- 250ksps Throughput Rate
- $\pm 0.5\text{ppm}$ INL (Typ)
- Guaranteed 20-Bit No Missing Codes
- Low Power: 5.3mW at 250ksps, 5.3 μW at 250sps
- 104dB SNR (Typ) at $f_{\text{IN}} = 2\text{kHz}$
- 125dB THD (Typ) at $f_{\text{IN}} = 2\text{kHz}$
- Digital Gain Compression (DGC)
- Guaranteed Operation to 85°C
- 2.5V Supply
- Fully Differential Input Range $\pm V_{\text{REF}}$
- V_{REF} Input Range from 2.5V to 5.1V
- No Pipeline Delay, No Cycle Latency
- 1.8V to 5V I/O Voltages
- SPI-Compatible Serial I/O with Daisy-Chain Mode
- Internal Conversion Clock
- 16-Lead MSOP and 4mm $\times$ 3mm DFN Packages

APPLICATIONS

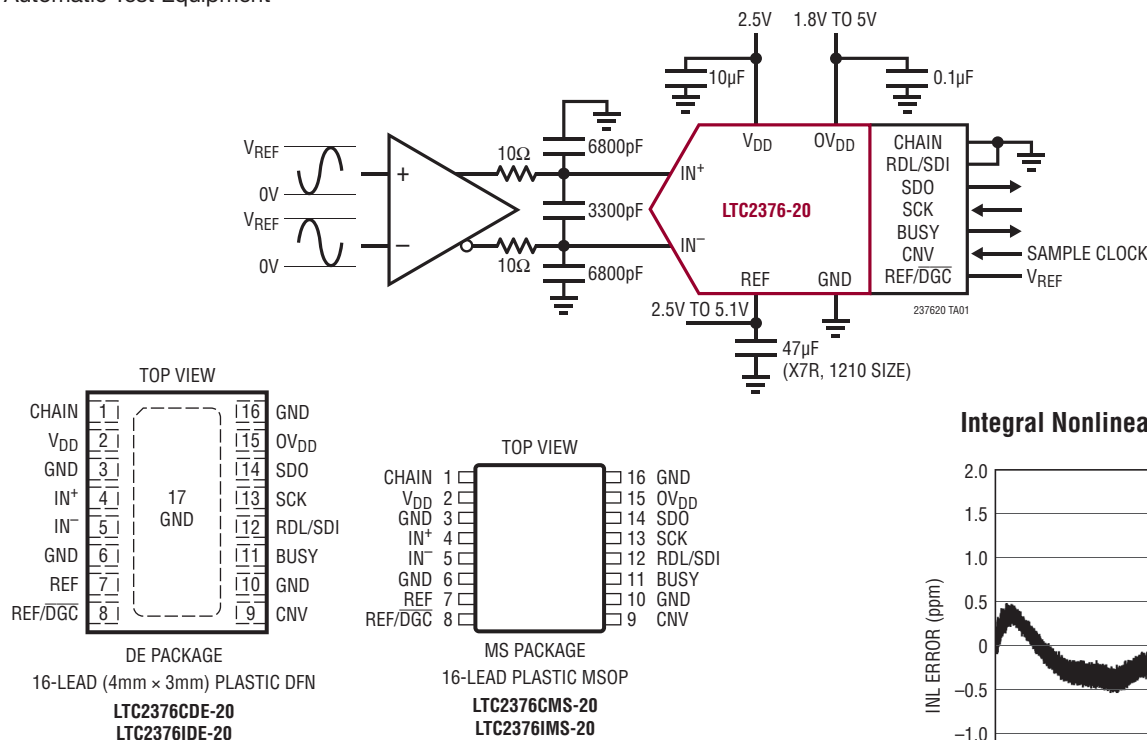
- Medical Imaging
- High Speed Data Acquisition
- Portable or Compact Instrumentation
- Industrial Process Control
- Low Power Battery-Operated Instrumentation
- Automatic Test Equipment

DESCRIPTION

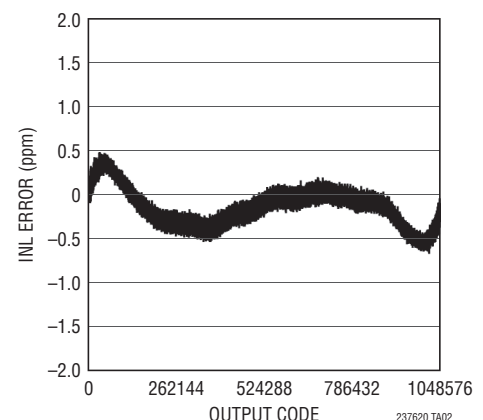
The LTC[®]2376-20 is a low noise, low power, high speed 20-bit successive approximation register (SAR) ADC. Operating from a 2.5V supply, the LTC2376-20 has a $\pm V_{\text{REF}}$ fully differential input range with V_{REF} ranging from 2.5V to 5.1V. The LTC2376-20 consumes only 5.3mW and achieves $\pm 2\text{ppm}$ INL maximum, no missing codes at 20 bits with 104dB SNR.

The LTC2376-20 has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3.3V and 5V logic while also featuring a daisy-chain mode. The fast 250ksps throughput with no cycle latency makes the LTC2376-20 ideally suited for a wide variety of high speed applications. An internal oscillator sets the conversion time, easing external timing considerations. The LTC2376-20 automatically powers down between conversions, leading to reduced power dissipation that scales with the sampling rate.

The LTC2376-20 features a unique digital gain compression (DGC) function, which eliminates the driver amplifier's negative supply while preserving the full resolution of the ADC. When enabled, the ADC performs a digital scaling function that maps zero-scale code from 0V to $0.1 \cdot V_{\text{REF}}$ and full-scale code from V_{REF} to $0.9 \cdot V_{\text{REF}}$. For a typical reference voltage of 5V, the full-scale input range is now 0.5V to 4.5V, which provides adequate headroom for powering the driving amplifier from a single 5.5V supply.



Integral Nonlinearity vs Output Code



LTC2377-20

20-Bit, 500ksps, Low Power SAR ADC
with 0.5ppm INL

FEATURES

- 500ksps Throughput Rate
- ±0.5ppm INL (Typ)
- Guaranteed 20-Bit No Missing Codes
- Low Power: 10.5mW at 500ksps, 10.5µW at 500sps
- 104dB SNR (Typ) at $f_{IN} = 2\text{kHz}$
- 125dB THD (Typ) at $f_{IN} = 2\text{kHz}$
- Digital Gain Compression (DGC)
- Guaranteed Operation to 85°C
- 2.5V Supply
- Fully Differential Input Range $\pm V_{REF}$
- V_{REF} Input Range from 2.5V to 5.1V
- No Pipeline Delay, No Cycle Latency
- 1.8V to 5V I/O Voltages
- SPI-Compatible Serial I/O with Daisy-Chain Mode
- Internal Conversion Clock
- 16-Lead MSOP and 4mm × 3mm DFN Packages

APPLICATIONS

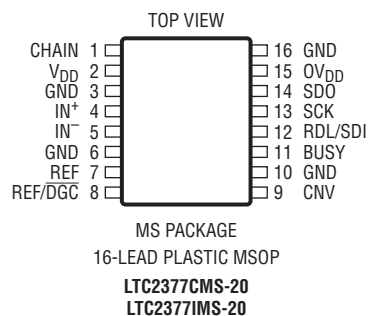
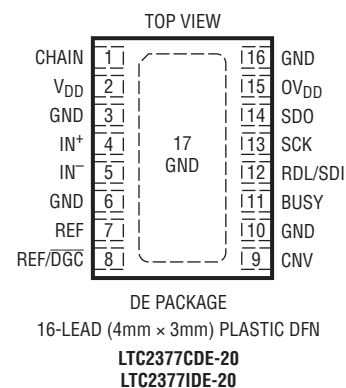
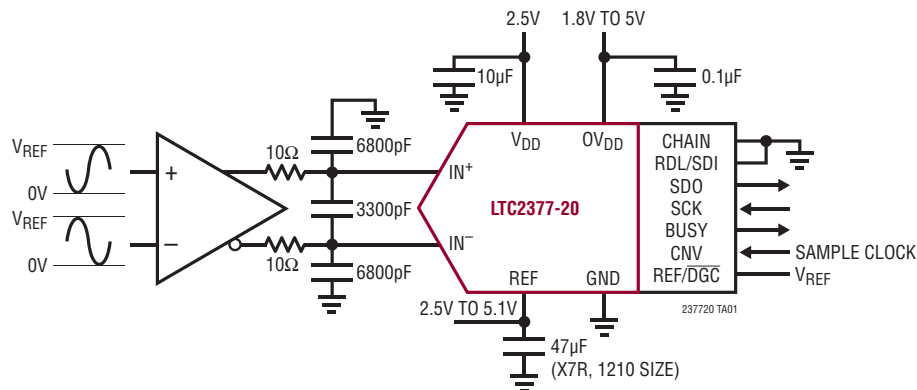
- Medical Imaging
- High Speed Data Acquisition
- Portable or Compact Instrumentation
- Industrial Process Control
- Low Power Battery-Operated Instrumentation
- Automatic Test Equipment

DESCRIPTION

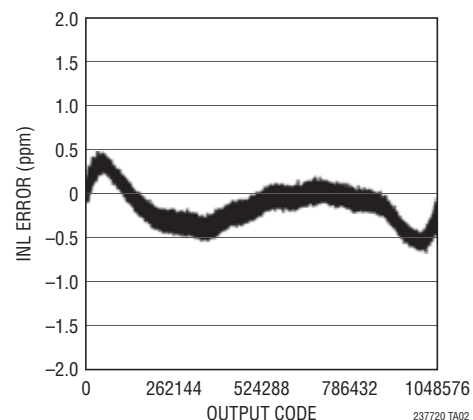
The LTC[®]2377-20 is a low noise, low power, high speed 20-bit successive approximation register (SAR) ADC. Operating from a 2.5V supply, the LTC2377-20 has a $\pm V_{REF}$ fully differential input range with V_{REF} ranging from 2.5V to 5.1V. The LTC2377-20 consumes only 10.5mW and achieves ±2ppm INL maximum, no missing codes at 20 bits with 104dB SNR.

The LTC2377-20 has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3.3V and 5V logic while also featuring a daisy-chain mode. The fast 500ksps throughput with no cycle latency makes the LTC2377-20 ideally suited for a wide variety of high speed applications. An internal oscillator sets the conversion time, easing external timing considerations. The LTC2377-20 automatically powers down between conversions, leading to reduced power dissipation that scales with the sampling rate.

The LTC2377-20 features a unique digital gain compression (DGC) function, which eliminates the driver amplifier's negative supply while preserving the full resolution of the ADC. When enabled, the ADC performs a digital scaling function that maps zero-scale code from 0V to $0.1 \cdot V_{REF}$ and full-scale code from V_{REF} to $0.9 \cdot V_{REF}$. For a typical reference voltage of 5V, the full-scale input range is now 0.5V to 4.5V, which provides adequate headroom for powering the driving amplifier from a single 5.5V supply.

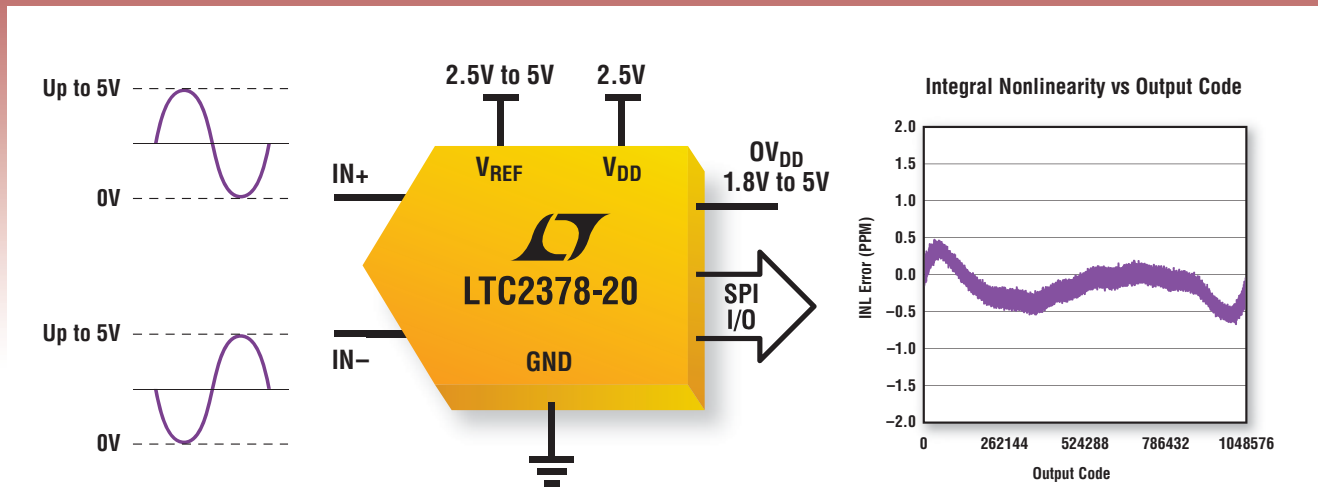


Integral Nonlinearity vs Output Code



20-Bit 1Msps SAR ADC

0.5ppm INL



No Latency SAR ADC Achieves 104dB SNR

The LTC[®]2378-20 SAR ADC achieves 20 bits of resolution with outstanding 0.5ppm INL and 104dB SNR performance with no cycle latency and sample rates up to 1Msps. It offers uncompromised performance, low power dissipation and excellent temperature stability for high precision signal chains. The LTC2378-20 family includes pin-compatible 20-/18-/16-bit SAR ADCs from 250ksps up to 2Msps with serial SPI interface and explicit Busy and Chain pins that simplify digital timing.

Features

- 1Msps Throughput Rate
- $\pm 0.5\text{ppm INL (Typ)}$, $\pm 2\text{ppm INL (Max)}$
- 104dB SNR (Typ) at $f_{\text{IN}} = 2\text{kHz}$
- -125dB THD (Typ) at $f_{\text{IN}} = 2\text{kHz}$
- Low Power: 21mW at 1Msps, 21 μW at 1ksps
- Fully Differential Input Range $\pm V_{\text{REF}}$
- V_{REF} Input Range from 2.5V to 5.1V
- Digital Gain Compression Eliminates Need for Negative Rails
- -40°C to +85°C Guaranteed Temperature Range
- 16-pin MSOP and 4mm x 3mm DFN Packages

Complete 20-/18-/16-Bit Pin-Compatible SAR ADC Family

	250ksps	500ksps	1Msps	1.6Msps	2Msps
20-Bit 104dB SNR	2376-20	2377-20	2378-20		
18-Bit 101dB SNR	2376-18	2377-18	2378-18	2379-18	
16-Bit 96dB SNR	2376-16	2377-16	2378-16		2380-16

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Info & Free Samples
1-800-4-LINEAR
www.linear.com/LTC2378-20



LTC3330

Nanopower Buck-Boost + DC/DC with Energy Harvesting Battery Life Extender

FEATURES

- **Dual Input, Single Output DC/DCs with Input Prioritizer**
 - **Energy Harvesting Input: 3.0V to 20V Buck DC/DC**
 - **Primary Cell Input: 1.8V to 5.5V Buck-Boost DC/DC**
- **Zero Battery I_Q When Powering Load from Harvested Energy**
- **Ultralow Quiescent Current: 750nA at No-Load**
- **Low Noise LDO Post Regulator**
- **Integrated Supercapacitor Balancer**
- **Up to 50mA of Output Current**
- **Programmable DC/DC and LDO Output Voltages, Buck UVLO, and Buck-Boost Peak Input Current**
- **Integrated Low Loss Full-Wave Bridge Rectifier**
- **Input Protective Shunt**
 - **Up to 25mA at $V_{IN} \geq 20V$**
- **5mm × 5mm QFN-32 Package**

APPLICATIONS

- Energy Harvesting
- Solar Powered Systems with Primary Cell Backup
- Wireless HVAC Sensors and Security Devices
- Mobile Asset Tracking

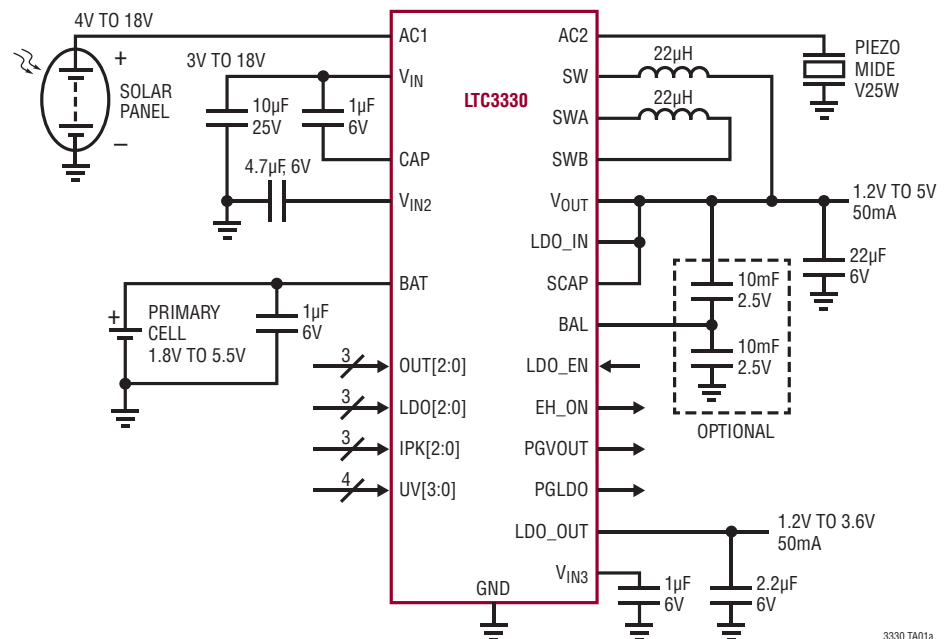
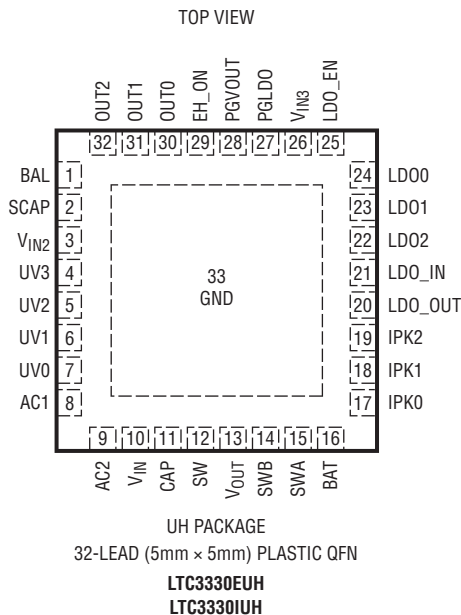
DESCRIPTION

The LTC®3330 integrates a high voltage energy harvesting power supply plus a DC/DC converter powered by a primary cell battery to create a single output supply for alternative energy applications. The energy harvesting power supply, consisting of an integrated full-wave bridge rectifier and a high voltage buck converter, harvests energy from piezoelectric, solar, or magnetic sources. The primary cell input powers a buck-boost converter capable of operation down to 1.8V at its input. Either DC/DC converter can deliver energy to a single output. The buck operates when harvested energy is available, reducing the quiescent current draw on the battery to essentially zero. The buck-boost takes over when harvested energy goes away.

A low noise LDO post regulator and a supercapacitor balancer are also integrated, accommodating a wide range of output storage configurations.

Voltage and current settings for both inputs and outputs are programmable via pin-strapped logic inputs.

The LTC3330 is available in a 5mm × 5mm QFN-32 package.



LTC5510

1MHz to 6GHz Wideband High Linearity Active Mixer

FEATURES

- Input/LO Frequency Range to 6GHz
- 50Ω Matched Input from 30MHz to >3GHz
- Capable of Upconversion or Downconversion
- OIP3: 27dBm at $f_{OUT} = 1575\text{MHz}$
- 1.5dB Conversion Gain
- Noise Figure: 11.6dB at $f_{OUT} = 1575\text{MHz}$
- High Input P1dB: 11dBm at 5V
- 5V or 3.3V Supply at 105mA
- Shutdown Control
- LO Input Impedance Always Matched
- 0dBm LO Drive Level
- On-Chip Temperature Monitor
- 40°C to 105°C Operation (T_C)
- 16-Lead (4mm × 4mm) QFN Package

APPLICATIONS

- Wideband Receivers/Transmitters
- Cable Downlink Infrastructure
- HF/VHF/UHF Mixer
- Wireless Infrastructure

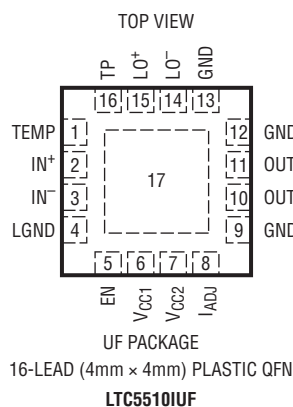
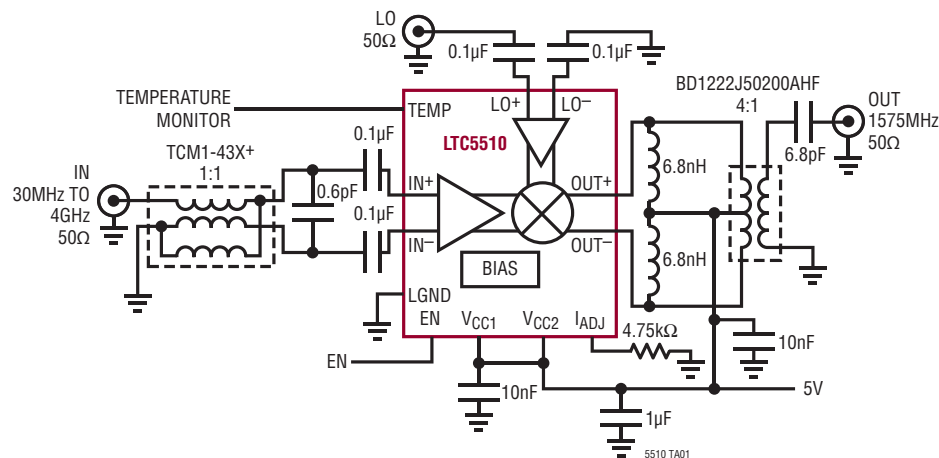
DESCRIPTION

The LTC®5510 is a high linearity mixer optimized for applications requiring very wide input bandwidth, low distortion, and low LO leakage. The chip includes a double-balanced active mixer with an input buffer and a high speed LO amplifier. The input is optimized for use with 1:1 transmission-line baluns, allowing very wideband impedance matching. The mixer can be used for both upconversion and downconversion and can be used in wideband systems.

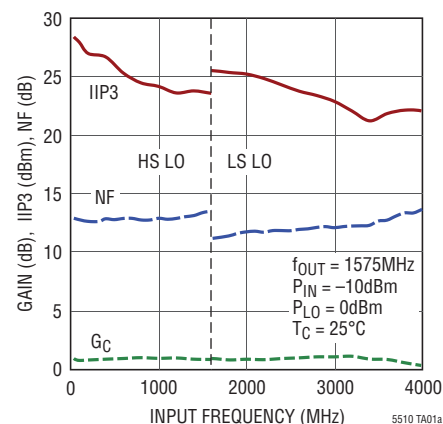
The LO can be driven differentially or single-ended and requires only 0dBm of LO power to achieve excellent distortion and noise performance, while also reducing external drive circuit requirements. The LTC5510 offers low LO leakage, greatly reducing the need for output filtering to meet LO suppression requirements.

The LTC5510 is optimized for 5V but can also be used with a 3.3V supply with slightly reduced performance. The shutdown function allows the part to be disabled for further power savings.

30MHz to 4GHz Up/Down Mixer for Wideband Receiver



Conversion Gain, IIP3 and NF vs Input Frequency



LTC4227

Dual Ideal Diode and Single Hot Swap Controller

FEATURES

- Power Path and Inrush Current Control for Redundant Supplies
- Low Loss Replacement for Power Schottky Diodes
- Allows Safe Hot Swapping from a Live Backplane
- 2.9V to 18V Operating Range
- Controls N-Channel MOSFETs
- Limits Peak Fault Current in $\leq 1\mu\text{s}$
- 0.5 μs Ideal Diode Turn-On and Reverse Turn-Off Time
- Adjustable Current Limit with Circuit Breaker
- Smooth Switchover without Oscillation
- Adjustable Current Limit Fault Delay
- Fault and Power Status Output
- 20-Lead 4mm $\times$ 5mm QFN and 16-Lead SSOP Packages

APPLICATIONS

- Redundant Power Supplies and Supply Holdup
- Computer Systems and Servers
- Telecom Networks

DESCRIPTION

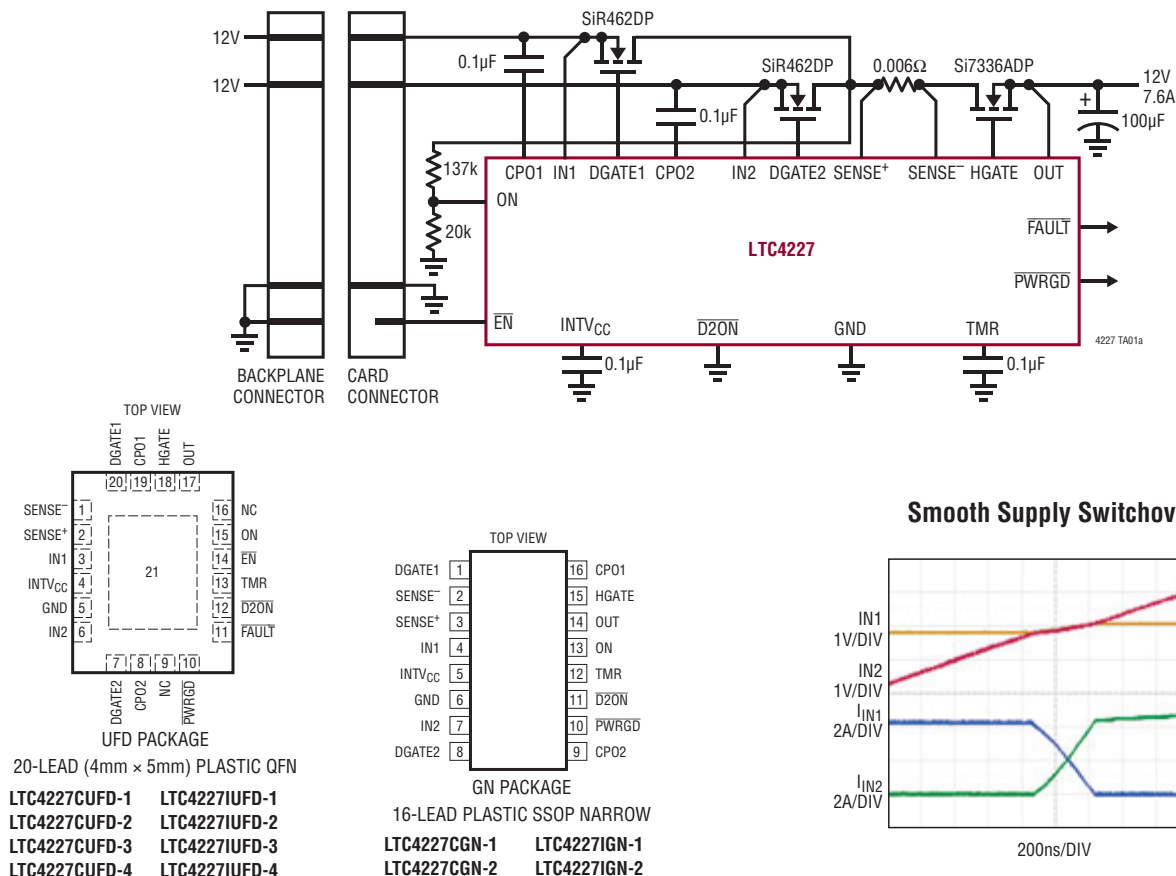
The LTC[®]4227 offers ideal diode-OR and Hot Swap[™] functions for two power rails by controlling external N-channel MOSFETs. MOSFETs acting as ideal diodes replace two high power Schottky diodes and the associated heat sinks, saving power and board area. A Hot Swap control MOSFET allows a board to be safely inserted and removed from a live backplane by limiting inrush current. The supply output is also protected against short-circuit faults with a fast acting current limit and internal timed circuit breaker.

The LTC4227 regulates the forward voltage drop across the MOSFETs to ensure smooth current transfer from one supply to the other without oscillation. The ideal diodes turn on quickly to reduce the load voltage droop during supply switchover. If the input supply fails or is shorted, a fast turn-off minimizes reverse-current transients.

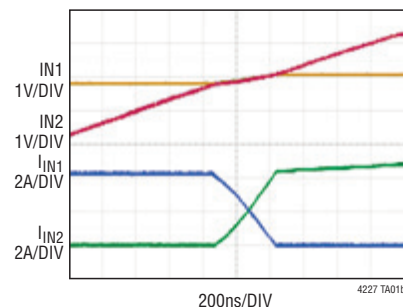
The LTC4227 allows turn-on/off control, and reports fault and power good status for the supply.

PART	OVERCURRENT FAULT	START-UP DELAY
LTC4227-1	LATCH OFF	100ms
LTC4227-2	RETRY	100ms
LTC4227-3	LATCH OFF	1.6ms
LTC4227-4	RETRY	1.6ms

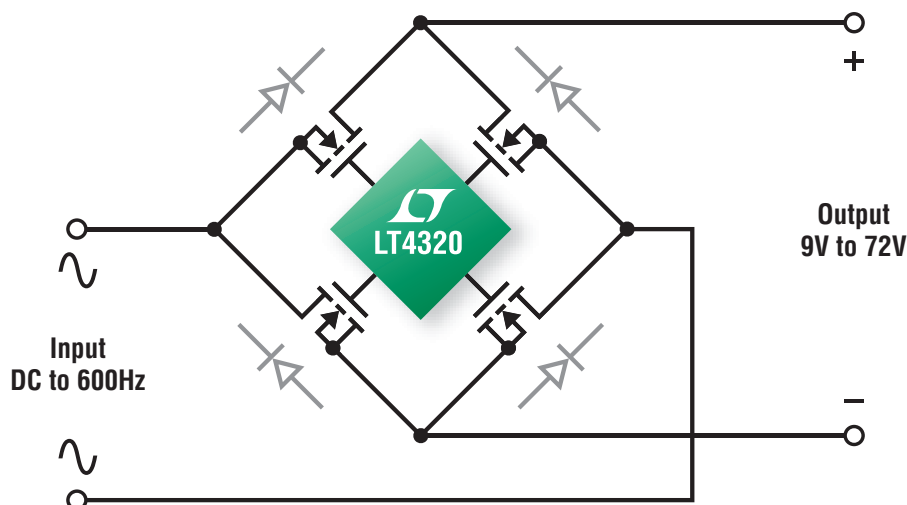
Diode-OR with Hot Swap Application



Smooth Supply Switchover



Ideal Diode Bridge



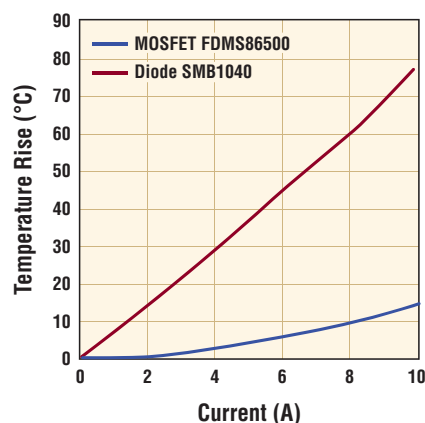
Active Diode Bridge Controller Minimizes Voltage Drop & Heat Sinking Requirements

The workhorse of AC to DC rectification, the classic four-diode bridge, just got a makeover. The LT[®]4320 simulates an ideal diode bridge by controlling four N-channel MOSFETs, significantly reducing heat dissipation and maximizing voltage to the application. Heat sinks can be eliminated, reducing solution size and cost. More power is available to the end application instead of being wasted as heat. Low voltage applications also benefit with the increased headroom provided by the MOSFET bridge.

▼ Features

- Low Loss Replacement for Diode Bridge
- Controls N-Channel MOSFETs
- Maximizes Power Efficiency
- Eliminates Thermal Design Problems
- Maximizes Available Voltage
- 9V to 72V Operating Voltage Range
- DC to 600Hz Operation
- $I_Q = 1.5\text{mA}$ (Typical)
- -55°C to $+125^\circ\text{C}$ Guaranteed Temperature Range
- 8-Pin 3mm x 3mm DFN and 12-Lead MSOP Packages

Temperature Rise vs Load Current



▼ Info & Free Samples

www.linear.com/product/LT4320

1-800-4-LINEAR



video.linear.com/136

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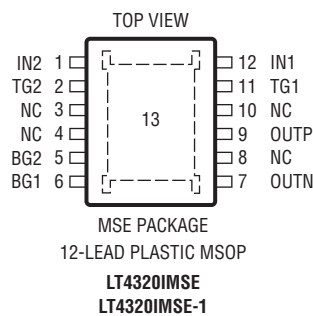
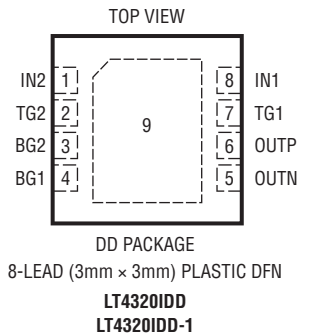
LT4320/LT4320-1 Ideal Diode Bridge Controller

FEATURES

- Maximizes Power Efficiency
- Eliminates Thermal Design Problems
- DC to 600Hz
- 9V to 72V Operating Voltage Range
- $I_Q = 1.5\text{mA}$ (Typical)
- Maximizes Available Voltage
- Available in 8-Lead (3mm × 3mm) DFN and 12-Lead MSOP Packages

APPLICATIONS

- Security Cameras
- Terrestrial or Airborne Power Distribution Systems
- Power-over-Ethernet Powered Device with a Secondary Input
- Polarity-Agnostic Power Input
- Diode Bridge Replacement

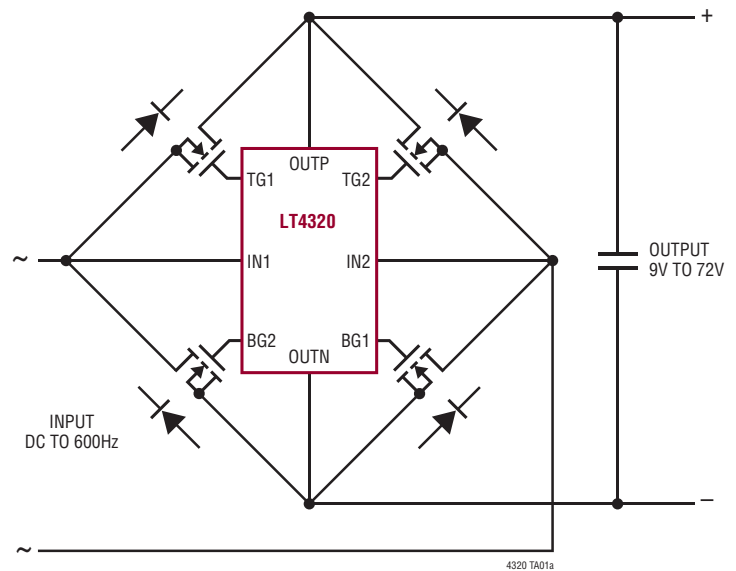


DESCRIPTION

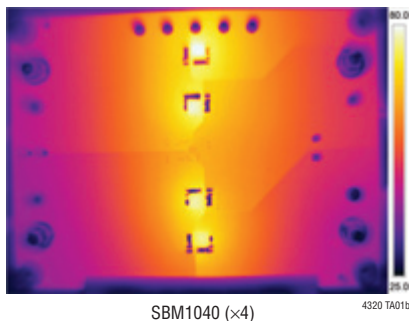
The LT[®]4320/LT4320-1 are ideal diode bridge controllers that drive four N-channel MOSFETs, supporting voltage rectification from DC to 600Hz. By maximizing available voltage and reducing power dissipation (see thermograph comparison below), the ideal diode bridge simplifies power supply design and reduces power supply cost, especially in low voltage applications.

An ideal diode bridge also eliminates thermal design problems, costly heat sinks, and greatly reduces PC board area. The LT4320's internal charge pump supports an all-NMOS design, which eliminates larger and more costly PMOS switches. If the power source fails or is shorted, a fast turn-off minimizes reverse current transients.

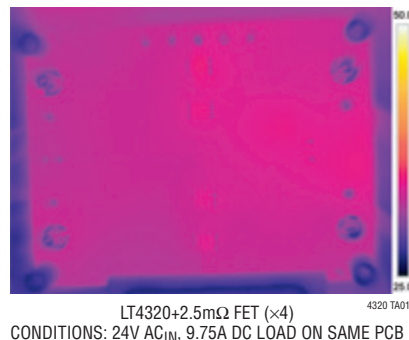
The LT4320 is designed for DC to 60Hz voltage rectification, while the LT4320-1 is designed for DC to 600Hz voltage rectification. Higher frequencies of operation are possible depending on MOSFET size and operating load current.



Thermograph of Passive Diode Bridge



Thermograph of LT4320 Driving Four MOSFETs



Temperature Rise (°C)

CURRENT (A)	MOSFET 2.5mΩ	DIODE SBM 1040
2	0.6	15
4	3.5	32
6	6.7	49
8	11	66
10	16	84

DC Input, on Same PCB

LT3007 Series

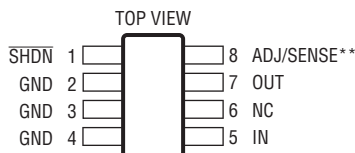
3 μ A I_Q , 20mA, 45V Low Dropout Fault Tolerant Linear Regulators

FEATURES

- **FMEA Fault Tolerant:**
Output Stays at or Below Regulation Voltage During Adjacent Pin Short or if a Pin Is Left Floating
- **Ultralow Quiescent Current: 3 μ A**
- **Input Voltage Range: 2.0V to 45V**
- **Output Current: 20mA**
- **Dropout Voltage: 300mV**
- **Adjustable Output ($V_{ADJ} = V_{OUT(MIN)} = 600mV$)**
- **Fixed Output Voltages: 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V**
- Output Tolerance: $\pm 2\%$ Over Load, Line and Temperature
- Stable with Low ESR, Ceramic Output Capacitors (2.2 μ F Minimum)
- Shutdown Current: <1 μ A
- Current Limit Protection
- Reverse-Battery Protection
- Thermal Limit Protection
- TSOT-23 Package

APPLICATIONS

- Automotive
- Low Current Battery-Powered Systems
- Keep-Alive Power Supplies
- Remote Monitoring
- Utility Meters
- Low Power Industrial Applications



TS8 PACKAGE

8-LEAD PLASTIC TSOT-23

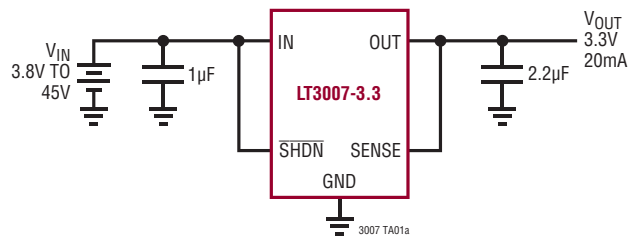
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LT3007ITS8	LT3007ETS8-2.5
LT3007ETS8-1.2	LT3007ITS8-2.5
LT3007ITS8-1.2	LT3007ETS8-3.3
LT3007ETS8-1.5	LT3007ITS8-3.3
T3007ITS8-1.5	LT3007ETS8-5
LT3007ETS8-1.8	LT3007ITS8-5

DESCRIPTION

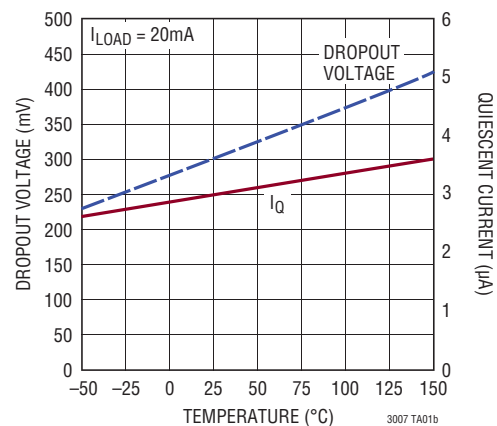
The LT[®]3007 series are micropower, low dropout voltage (LDO) linear regulators. The devices supply 20mA output current with a dropout voltage of 300mV. No-load quiescent current is 3 μ A. Ground pin current remains at less than 5% of output current as load increases. In shutdown, quiescent current is less than 1 μ A. The LT3007 regulators optimize stability and transient response with low ESR ceramic capacitors, requiring a minimum of only 2.2 μ F. The regulators do not require the addition of ESR as is common with other regulators. Internal protection circuitry includes current limiting, thermal limiting, reverse-battery protection and reverse-current protection.

The LT3007 series are ideal for applications that require moderate output drive capability coupled with ultralow standby power consumption. The device is available in fixed output voltages of 1.2V, 1.5V, 1.8V, 2.5V, 3.3V and 5V, and an adjustable version with an output voltage range of 0.6V to 44.5V. The LT3007 is available in the thermally enhanced 8-lead TSOT-23 package.

3.3V, 20mA Supply with Shutdown



Dropout Voltage/Quiescent Current



LT3055

500mA, Linear Regulator with Precision Current Limit and Diagnostics

FEATURES

- Output Current: 500mA
- Dropout Voltage: 350mV
- Input Voltage Range: 2V to 45V
- Programmable Precision Current Limit: $\pm 10\%$
- Output Current Monitor: $1/500\text{th}$ of I_{OUT}
- Programmable Minimum I_{OUT} Monitor
- Temperature Monitor: $10\text{mV}/^\circ\text{C}$
- FAULT Indicator: Current Limit, Thermal Limit or Minimum I_{OUT}
- Low Noise: $25\mu\text{V}_{\text{RMS}}$ (10Hz to 100kHz)
- Adjustable Output ($V_{\text{REF}} = V_{\text{OUT(MIN)}} = 0.6\text{V}$)
- Output Tolerance: $\pm 2\%$ Over Load, Line and Temperature
- Stable with Low ESR, Ceramic Output Capacitors (3.3 μF Minimum)
- Shutdown Current: $< 1\mu\text{A}$
- Reverse Battery and Thermal Limit Protection
- 16-Lead 4mm $\times$ 3mm DFN and MSOP Packages

APPLICATIONS

- Protected Antenna Supplies
- Automotive Telematics
- Industrial Applications (Trucks, Forklifts, etc.)
- High Reliability Applications
- Noise-Sensitive RF or DSP Supplies

DESCRIPTION

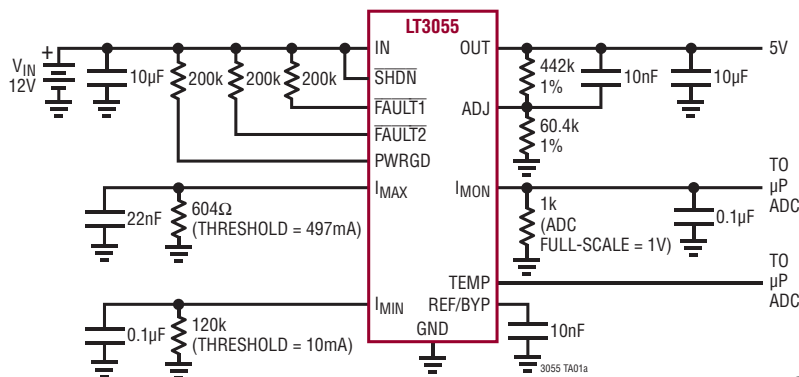
The LT[®]3055 is a micropower, low noise, low dropout voltage (LDO) linear regulator. The device supplies 500mA of output current with a dropout voltage of 350mV. A 10nF bypass capacitor reduces output noise to $25\mu\text{V}_{\text{RMS}}$ in a 10Hz to 100kHz bandwidth and soft starts the reference. The LT3055's $\pm 45\text{V}$ input voltage rating combined with its precision current limit and diagnostic functions make the IC an ideal choice for robust, high reliability applications.

A single resistor programs the LT3055's current limit, accurate to $\pm 10\%$ over a wide input voltage and temperature range. Another resistor programs the LT3055's minimum output current monitor, useful for detecting open-circuit conditions. The current monitor function sources a current equal to $1/500\text{th}$ of output current. Logic fault pins assert low if the LT3055 is in current limit (FAULT2), operating below its minimum output current (FAULT1) or is in thermal limit (both FAULT1 and FAULT2). PWRGD indicates output regulation. The TEMP pin indicates average die temperature.

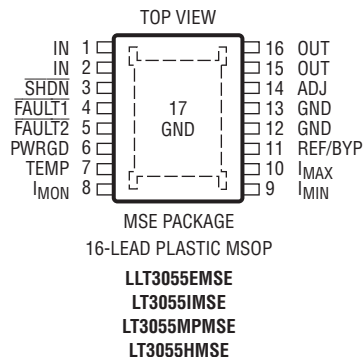
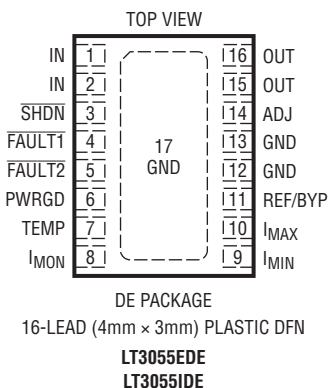
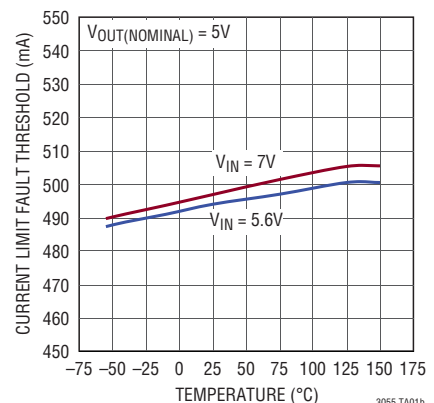
The LT3055 optimizes stability and transient response with low ESR ceramic capacitors, requiring a minimum of 3.3 μF . Internal protection circuitry includes current limiting, thermal limiting, reverse battery protection, reverse current protection and reverse output protection.

The LT3055 is available as an adjustable device with an output voltage range from 0.6V to 40V.

5V Supply with 497mA Precision Current Limit, 10mA I_{MIN}



Precision Current Limit, $R_{\text{IMAX}} = 604\Omega$



LT3081

1.5A Single Resistor Rugged Linear Regulator with Monitors

FEATURES

- Extended Safe Operating Area
- Maximum Output Current: 1.5A
- Stable with or without Input/Output Capacitors
- Wide Input Voltage Range: 1.2V to 36V
- Single Resistor Sets Output Voltage
- Output Current Monitor: $I_{MON} = I_{OUT}/5000$
- Junction Temperature Monitor: $1\mu A/^{\circ}C$
- Output Adjustable to 0V
- 50 μA SET Pin Current: 1% Initial Accuracy
- Output Voltage Noise: $27\mu V_{RMS}$
- Parallel Multiple Devices for Higher Current or Heat Spreading
- Programmable Current Limit
- Reverse-Battery and Reverse-Current Protection
- <1mV Load Regulation Typical Independent of V_{OUT}
- <0.001%/V Line Regulation Typical
- Available in Thermally Enhanced 12-Lead 4mm $\times$ 4mm DFN and 16-Lead TSSOP, 7-Lead DD-Pak and 7-Lead TO-220

APPLICATIONS

- All Surface Mount Power Supply
- Rugged Industrial Power Supply
- Post Regulator for Switching Supplies
- Low Output Voltage Supply
- Intrinsic Safety Applications

DESCRIPTION

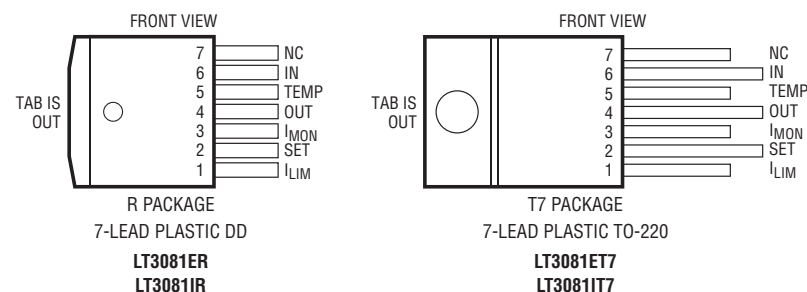
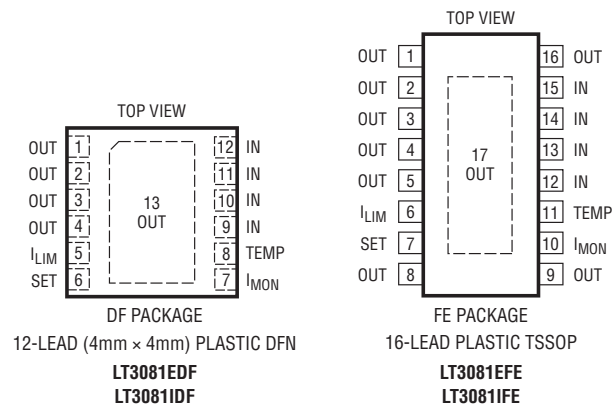
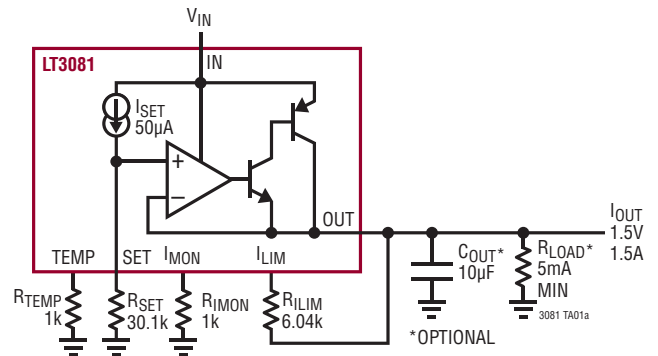
The LT[®]3081 is a 1.5A low dropout linear regulator designed for rugged industrial applications. Key features of the IC are the extended safe operating area (SOA), output current monitor, temperature monitor and programmable current limit. The LT3081 can be paralleled for higher output current or heat spreading. The device withstands reverse input and reverse output-to-input voltages without reverse current flow.

The LT3081's precision 50 μA reference current source allows a single resistor to program output voltage to any level between zero and 34.5V. The current reference architecture makes load regulation independent of output voltage. The LT3081 is stable with or without input and output capacitors.

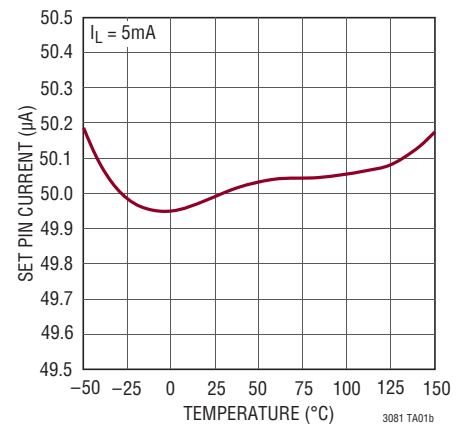
The output current monitor ($I_{OUT}/5000$) and die junction temperature output ($1\mu A/^{\circ}C$) provide system monitoring and debug capability. In addition, a single resistor pro-grams current limit.

Internal protection circuitry includes reverse-battery and reverse-current protection, current limiting and thermal limiting. The LT3081 is offered in the 16-lead TSSOP (with exposed pad for improved thermal performance), 7-lead TO-220, 7-lead DD-Pak, and an 12-lead 4mm $\times$ 4mm DFN.

Wide Safe Operating Area Supply



SET Pin Current



LT3090

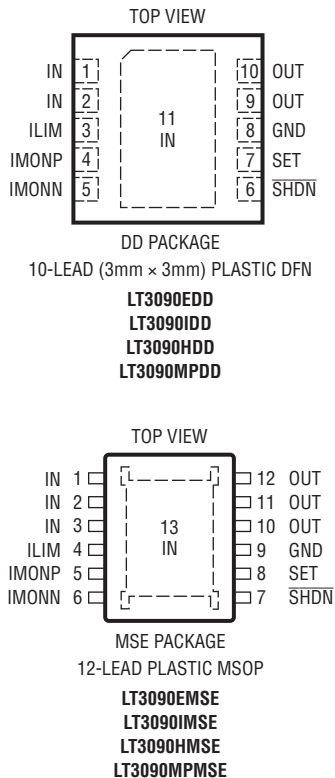
–36V, 600mA Negative Linear Regulator with Programmable Current Limit

FEATURES

- **Output Current: 600mA**
- **Single Resistor Sets Output Voltage**
- **50 μ A SET Pin Current: $\pm 1\%$ Initial Accuracy**
- **Programmable Current Limit**
- **Bipolar Output Current Monitor**
- **Parallelable for Higher Current and Heat Spreading**
- **Low Dropout Voltage: 300mV**
- **Low Output Noise: 20 μ V_{RMS} (10Hz to 100kHz)**
- **Configurable as 3-Terminal Floating Regulator**
- **Wide Input Voltage Range: –1.5V to –36V**
- **Rail-to-Rail Output Voltage Range: 0V to –35.5V**
- Positive/Negative Shutdown Logic or UVLO
- Internal Back-Up Current Limit with Foldback
- Load Regulation: 100 μ V (1mA to 600mA)
- Line Regulation: 20ppm/V
- Stable with 4.7 μ F Minimum Output Capacitor
- Stable with Ceramic or Tantalum Capacitors
- Reverse Output Protection
- Thermally Enhanced 10-Lead MSOP and 10-Lead 0.75mm $\times$ 3mm $\times$ 3mm DFN Packages

APPLICATIONS

- Post Regulator for Switching Supplies
- Low Noise Instrumentation and RF Supplies
- Rugged Industrial Supplies
- Precision Power Supplies

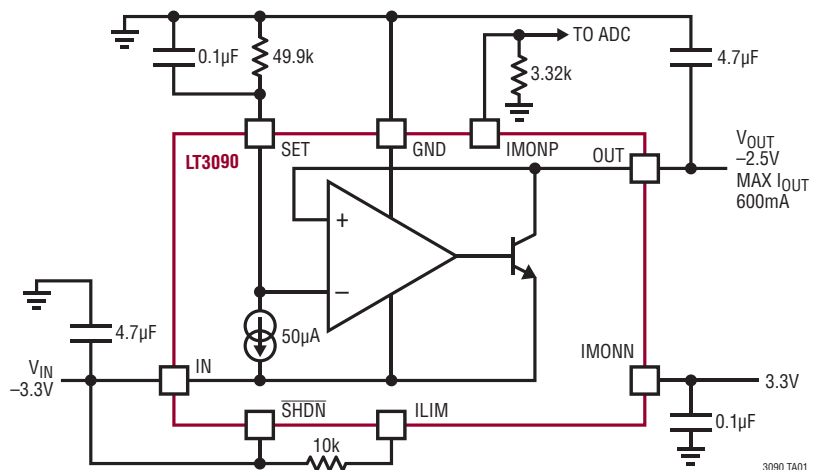


DESCRIPTION

The LT[®]3090 is a 600mA, low dropout negative linear regulator that is easily parallelable to increase output current or spread heat on surface mounted boards. Designed with a precision current reference followed by a high performance rail-to-rail voltage buffer, this regulator finds use in applications requiring precision output, high current with no heat sink, output adjustability to zero and low dropout voltage. This new architecture can also be configured as a 3-terminal floating regulator.

The LT3090 features fast transient response, high PSRR and output noise as low as 20 μ V_{RMS}, making it ideal for noise sensitive RF applications. The LT3090's architecture allows it to generate a wide output voltage range (0V to –35.5V) while maintaining unity gain operation. This yields virtually constant bandwidth, load regulation, PSRR and noise, regardless of the programmed output voltage.

The LT3090 supplies 600mA at a typical dropout voltage of 300mV. Operating quiescent current is nominally 1mA and drops to $\ll 1\mu$ A in shutdown. A single resistor adjusts the LT3090's precision programmable current limit. The LT3090's bipolar current monitor either sinks a current (0.5mA/A) or sources a current (1mA/A) proportional to output current. Built-in protection includes reverse output protection, internal current limit with foldback and thermal shutdown with hysteresis.



LT3955

60V_{IN} LED Converter with Internal PWM Generator

FEATURES

- 3000:1 True Color PWM™ Dimming for LEDs
- Wide V_{IN} Range: 4.5V to 60V
- Rail-to-Rail Current Sense Range: 0V to 80V
- Internal 80V/3.5A Switch
- Programmable PWM Dimming Signal Generator
- Constant Current (±3%) and Constant-Voltage (±2%) Regulation
- Accurate Analog Dimming
- Drives LEDs in Boost, SEPIC, CUK, Buck Mode, Buck-Boost Mode, or Flyback Configuration
- Output Short-Circuit Protected Boost
- Open LED Protection and Reporting
- Adjustable Switching Frequency: 100kHz to 1MHz
- Programmable V_{IN} UVLO with Hysteresis
- C/10 Indication for Battery Chargers
- Low Shutdown Current: <1μA
- Thermally Enhanced 5mm × 6mm QFN Package

APPLICATIONS

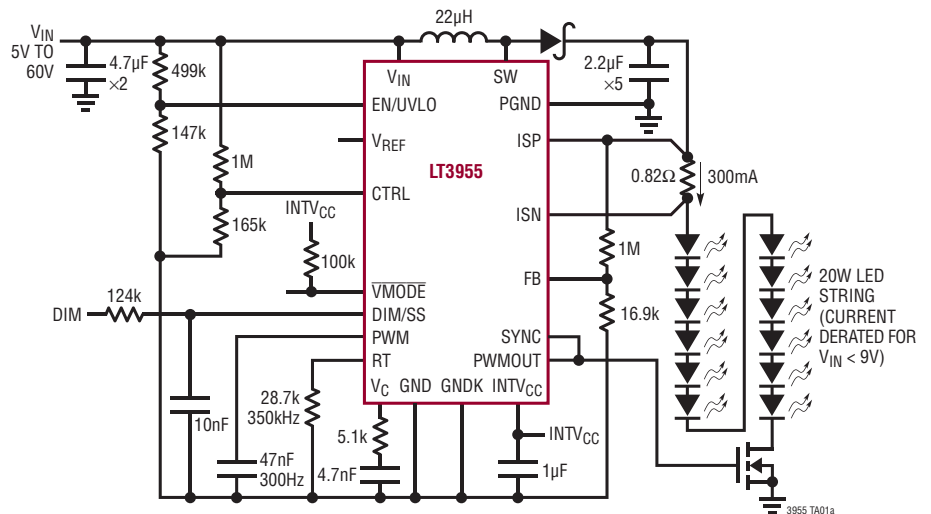
- High Power LEDs
- Output Short-Circuit Protected Boost
- Battery and Supercap Chargers
- Accurate Current Limited Voltage Regulators

DESCRIPTION

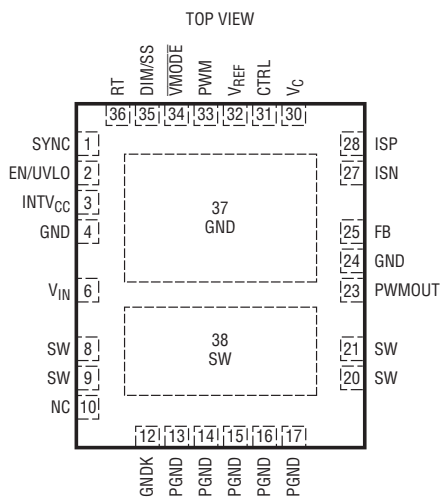
The LT®3955 is a DC/DC converter designed to operate as a constant-current source and constant-voltage regulator. It features an internal low side N-channel MOSFET rated for 80V/3.5A. The LT3955 is ideally suited for driving high current LEDs, but also has features to make it suitable for charging batteries and supercapacitors. The fixed frequency, current mode architecture results in stable operation over a wide range of supply and output voltages. A voltage feedback pin serves as the input for several LED protection features, and also makes it possible for the converter to operate as a constant-voltage source. A frequency adjust pin allows the user to program the frequency from 100kHz to 1MHz to optimize efficiency, performance or external component size.

The LT3955 senses output current at the high side or at the low side of the load. The PWM input can be configured to self-oscillate at fixed frequency with duty ratio programmable from 4% to 96%. When driven by an external signal, the PWM input provides LED dimming ratios of up to 3000:1. The CTRL input provides additional analog dimming capability.

94% Efficiency 20W Boost LED Driver with Internal PWM Dimming

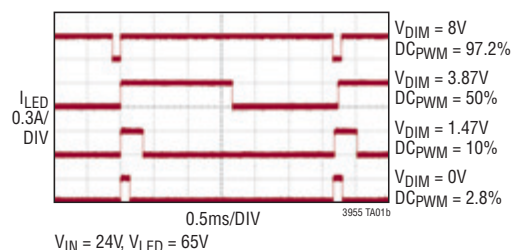


NOTE: GND, GNDK AND SIGNAL LEVEL COMPONENTS MUST BE CONNECTED EXTERNALLY AS SHOWN. AN INTERNAL CONNECTION BETWEEN GNDK AND PGND PINS PROVIDES GROUNDING TO THE SUPPLY.



UHE PACKAGE
36-LEAD (5mm × 6mm) PLASTIC QFN
LT3955EUHE
LT3955IUHE

PWM Dimming Waveforms at Various DIM Voltage Settings



LTM4637

20A DC/DC μModule Step-Down Regulator

FEATURES

- Complete 20A Switch Mode Power Supply
- 4.5V to 20V Input Voltage Range
- 0.6V to 5.5V Output Voltage Range
- ±1.5% Total DC Output Voltage Error (–40°C to 125°C)
- Differential Remote Sense Amplifier for Precision Regulation for ($V_{OUT} \leq 3.3V$)
- Current Mode Control/Fast Transient Response
- Parallel Current Sharing (Up to 80A)
- Frequency Synchronization
- Selectable Pulse-Skipping or Burst Mode® Operation
- Soft-Start/Voltage Tracking
- Up to 88% Efficiency (12V_{IN}, 1.8V_{OUT})
- Overcurrent Foldback Protection
- Output Overvoltage Protection
- Internal Temperature Monitor
- Overtemperature Protection
- 15mm × 15mm × 4.32mm LGA Package

APPLICATIONS

- Telecom Servers and Networking Equipment
- Industrial Equipment
- Medical Systems
- High Ambient Temperature Systems

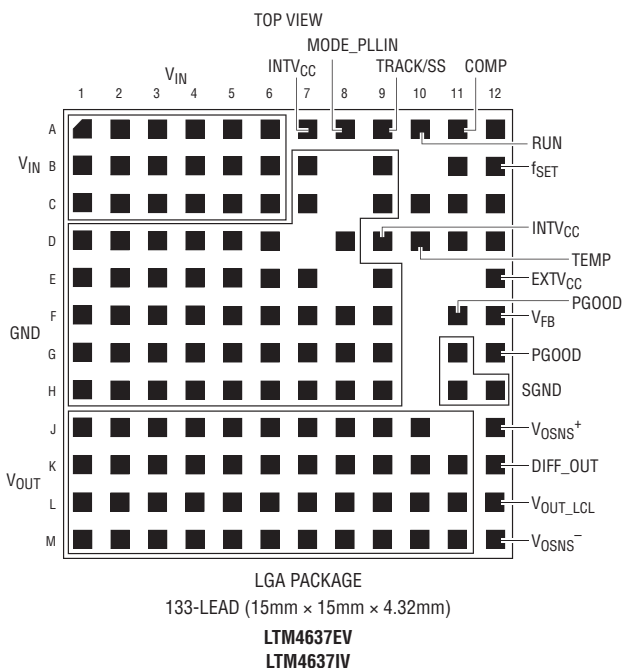
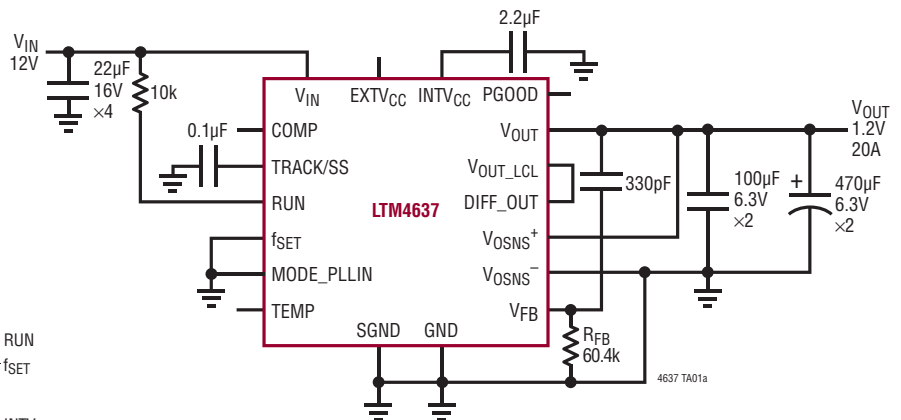
DESCRIPTION

The LTM4637 is a complete 20A output high efficiency switch mode step-down DC/DC μModule (micromodule) regulator. Included in the package are the switching controller, power FETs, inductor and compensation components. Operating over an input voltage range from 4.5V to 20V, the LTM4637 supports an output voltage range of 0.6V to 5.5V, set by a single external resistor. Only a few input and output capacitors are needed.

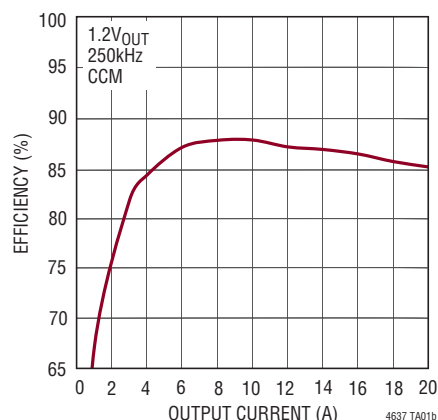
Current mode operation allows precision current sharing of up to four LTM4637 regulators to obtain up to 80A output. High switching frequency and a current mode architecture enable a very fast transient response to line and load changes without sacrificing stability. The device supports frequency synchronization, multiphase/current sharing, Burst Mode operation and output voltage tracking for supply rail sequencing. A diode-connected PNP transistor is available for use as an internal temperature monitor.

The LTM4637 is offered in a 15mm × 15mm × 4.32mm LGA package. The LTM4637 is RoHS compliant. The LTM4637 is pin compatible with the LTM4627, a 15A DC/DC μModule regulator.

12V_{IN}, 1.2V_{OUT}, 20A DC/DC μModule® Regulator



12V_{IN} Efficiency vs Load Current



LTM4649

10A Step-Down DC/DC μModule Regulator

FEATURES

- 10A DC Output Current
- Input Voltage Range: 4.5V to 16V
- Output Voltage Range: 0.6V Up to 3.3V
- No Heat Sink or Current Derating Up to 85°C Ambient Temperature
- ±1.5% Total DC Voltage Output Error
- Multiphase Operation with Current Sharing
- Remote Sense Amplifier
- Built-In General Use Temperature Monitor
- Selectable Pulse-Skipping Mode/Burst Mode® Operation for High Efficiency at Light Load
- Soft-Start/Voltage Tracking
- Protection: Output Overvoltage and Overcurrent Foldback
- 9mm × 15mm × 4.92mm BGA Package

APPLICATIONS

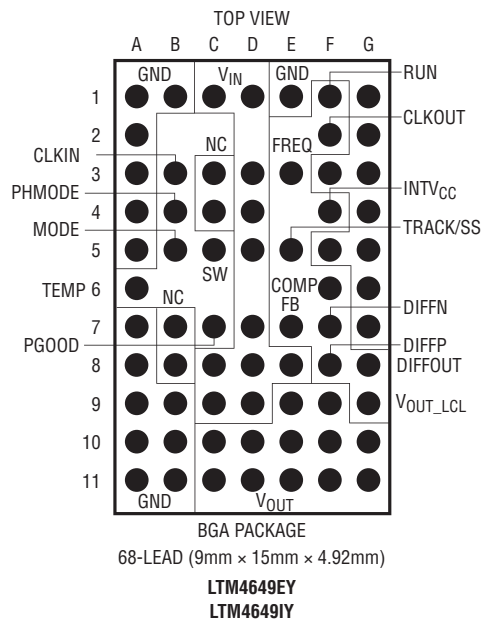
- Telecom, Networking and Industrial Equipment
- Point-of-Load Regulation

DESCRIPTION

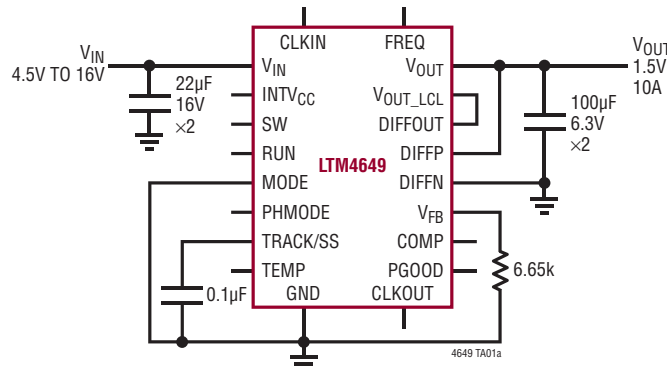
The LTM4649 is a complete 10A high efficiency switching mode step-down DC/DC μModule® regulator in a 9mm × 15mm × 4.92 BGA package. Included in the package are the switching controller, power FETs, inductor, and all support components. Operating over an input voltage range of 4.5V to 16V, the LTM4649 supports an output voltage range of 0.6V to 3.3V, set by a single external resistor. This high efficiency design delivers 10A continuous current. Only bulk input and output capacitors are needed.

High switching frequency and a current mode architecture enables a very fast transient response to line and load changes without sacrificing stability. The device supports frequency synchronization, programmable multiphase operation, spread spectrum, output voltage tracking for supply rail sequencing.

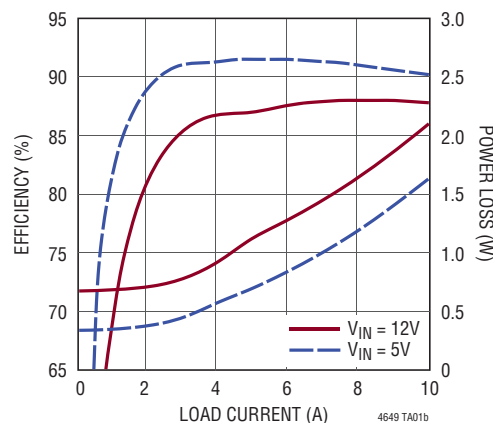
Fault protection features include overvoltage protection, overcurrent protection. The LTM4649 is offered in a small thermally enhanced 9mm × 15mm × 4.92mm BGA package. The LTM4649 is RoHS compliant.



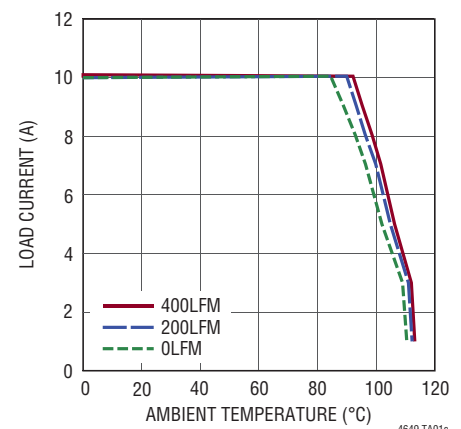
4.5V to 16V Input, 1.5V Output DC/DC μModule Regulator



Efficiency and Power Loss at 12V and 5V Input



Current Derating: 12V Input, 1.5V_{OUT}, No Heat Sink



LTM8028

36V_{IN}, UltraFast, Low Output Noise
5A μModule Regulator

FEATURES

- High Performance 5A Linear Regulator with Switching Step-Down Converter for High Efficiency
- Digitally Programmable V_{OUT}: 0.8V to 1.8V
- Input Voltage Range: 6V to 36V
- Very Tight Tolerance Over Temperature, Line, Load and Transient Response
- Low Output Noise: 40μV_{RMS} (10Hz to 100kHz)
- Parallel Multiple Devices for 10A or More
- Accurate Programmable Current Limit to Allow Asymmetric Power Sharing
- Analog Output Margining: ±10% Range
- Synchronization Input
- Stable with Low ESR Ceramic Output Capacitors
- 15mm × 15mm × 4.92mm Surface Mount BGA Package

APPLICATIONS

- FPGA and DSP Supplies
- High Speed I/O
- ASIC and Microprocessor Supplies
- Servers and Storage Devices

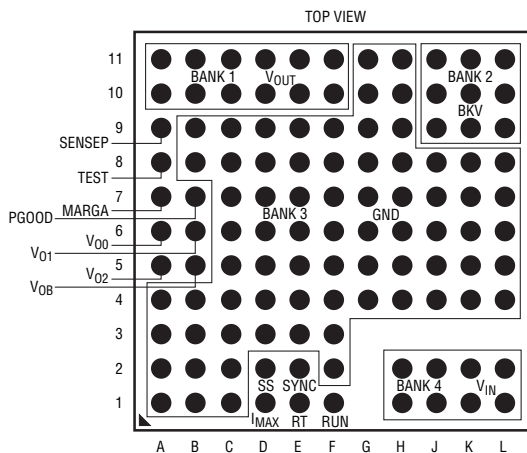
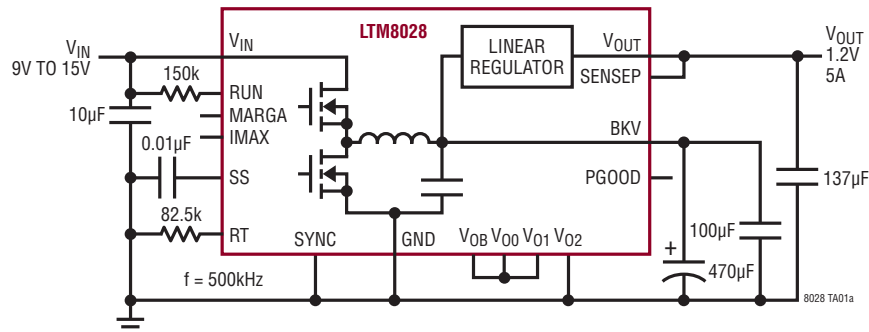
DESCRIPTION

The LTM8028 is a 36V_{IN}, 5A μModule[®] regulator, consisting of an UltraFast™ 5A linear regulator preceded by a high efficiency switching regulator. In addition to providing tight output regulation, the linear regulator automatically controls the output voltage of the switcher to provide optimal efficiency and headroom for dynamic response.

The output voltage is digitally selectable in 50mV increments over a 0.8V to 1.8V range. An analog margining function allows the user to adjust system output voltage over a continuous ±10% range, and a single-ended feedback sense line may be used to mitigate IR drops due to parasitic resistance.

The LTM8028 is packaged in a compact (15mm × 15mm × 4.92mm) overmolded ball grid array (BGA) package suitable for automated assembly by standard surface mount equipment. The LTM8028 is RoHS compliant.

Low Output Noise, 1.2V, 5A μModule Regulator



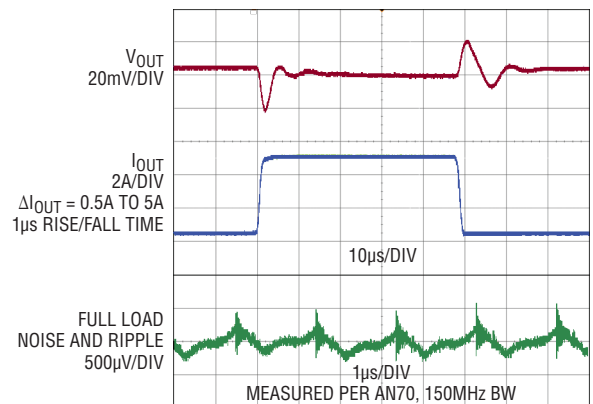
BGA PACKAGE

114 PADS (15mm × 15mm × 4.92mm)

LTM8028EY

LTM8028IY

LTM8028MPY



8028 TA01b

LTC3676/LTC3676-1

Power Management Solution for Application Processor

FEATURES

- Quad I²C Adjustable High Efficiency Step Down DC/DC Converters: 2.5A, 2.5A, 1.5A, 1.5A
- Three 300mA LDO Regulators (Two Adjustable)
- DDR Power Solution with VTT and VTTR Reference
- Pushbutton ON/OFF Control with System Reset
- Independent Enable Pin-Strap or I²C Sequencing
- Programmable Autonomous Power-Down Control
- Dynamic Voltage Scaling
- Power Good and Reset Functions
- Selectable 2.25MHz or 1.12MHz Switching Frequency
- Always Alive 25mA LDO Regulator
- 12μA Standby Current
- Low Profile 40-Lead 6mm × 6mm × 0.75mm QFN Package

APPLICATIONS

- Supports Freescale i.MX6, ARM Cortex, and Other Application Processors
- Handheld Instruments and Scanners
- Portable Industrial and Medical Devices
- Automotive Infotainment
- High End Consumer Devices
- Multirail Systems

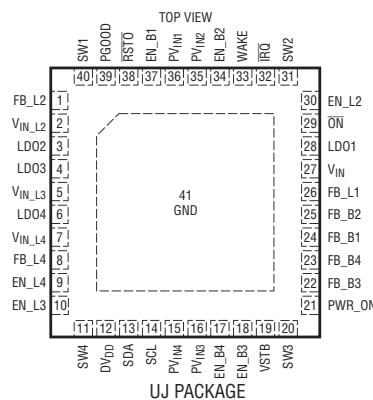
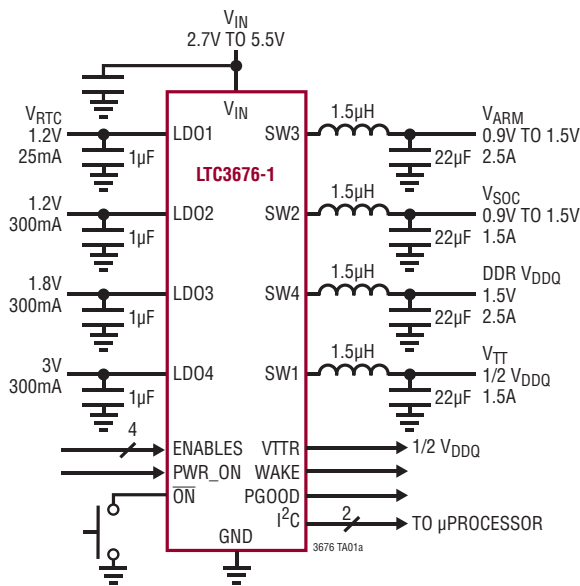
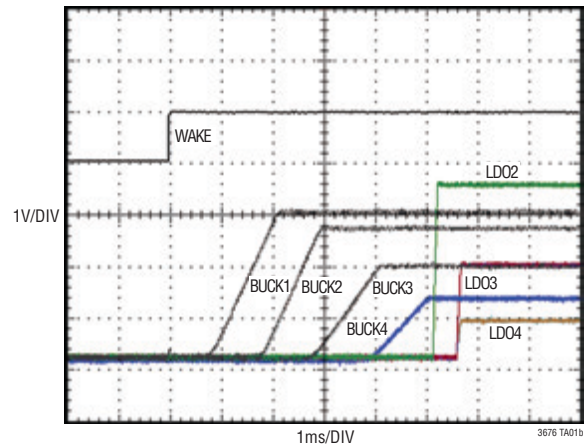
DESCRIPTION

The LTC[®]3676 is a complete power management solution for advanced portable application processor-based systems. The device contains four synchronous step-down DC/DC converters for core, memory, I/O, and system on-chip (SoC) rails and three 300mA LDO regulators for low noise analog supplies. The LTC3676-1 has a ±1.5A buck regulator configured to support DDR termination plus a VTTR reference output. An I²C serial port is used to control regulator enables, power-down sequencing, output voltage levels, dynamic voltage scaling, operating modes and status reporting.

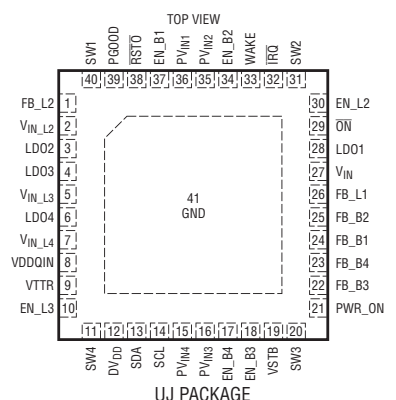
Regulator start-up is sequenced by connecting outputs to enable pins in the desired order or via the I²C port. System power-on, power-off and reset functions are controlled by pushbutton interface, pin inputs, or I²C.

The LTC3676 supports i.MX, PXA and OMAP processors with eight independent rails at appropriate power levels. Other features include interface signals such as the VSTB pin that toggles between programmed run and standby output voltages on up to four rails simultaneously. The device is available in a 40-lead 6mm × 6mm QFN package.

Start-Up Sequence



40-LEAD (6mm × 6mm) PLASTIC QFN
LTC3676EUJ LTC3676IUJ LTC3676HUJ



40-LEAD (6mm × 6mm) PLASTIC QFN
LTC3676EUJ-1 LTC3676IUJ-1 LTC3676HUJ-1

LTC2978A

8-Channel PMBus Power System Manager

Featuring Accurate Output Voltage Measurement

FEATURES

- Sequence, Trim, Margin and Supervise Eight Power Supplies
- Manage Faults, Monitor Telemetry and Create Fault Logs
- PMBus Compliant Command Set
- Supported by LTpowerPlay™ GUI
- Margin or Trim Supplies to 0.25% Accuracy
- Fast OV/UV Supervisors per Channel
- Coordinate Sequencing and Fault Management Across Multiple Chips
- Automatic Fault Logging to Internal EEPROM
- Operate Autonomously without Additional Software
- Internal Temperature and Input Voltage Supervisors
- Accurate Monitoring of Eight Output Voltages, Input Voltage and Internal Die Temperature
- I²C/SMBus Serial Interface
- Can Be Powered from 3.3V, or 4.5V to 15V
- Programmable Watchdog Timer
- 100% Compatible with the LTC2978
- Available in 64-Pin 9mm × 9mm QFN Package

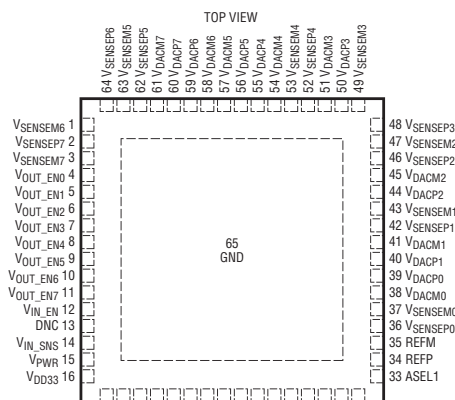
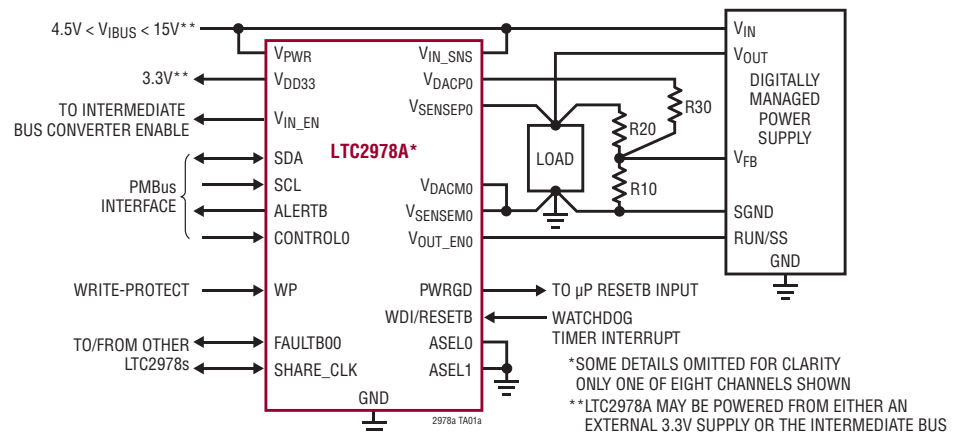
APPLICATIONS

- Computers and Network Servers
- Industrial Test and Measurement
- High Reliability Systems
- Medical Imaging
- Video

DESCRIPTION

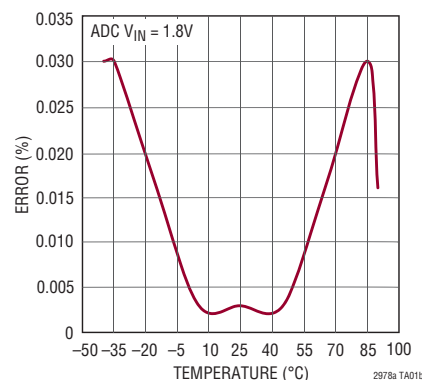
The LTC[®]2978A is an 8-channel Power System Manager used to sequence, trim (servo), margin, supervise, manage faults, provide telemetry and create fault logs. PMBus commands support power supply sequencing, precision point-of-load voltage adjustment and margining. DACs use a proprietary soft-connect algorithm to minimize supply disturbances. Supervisory functions include overvoltage and undervoltage threshold limits for eight power supply output channels and one power supply input channel, as well as overtemperature and undertemperature limits. Programmable fault responses can disable the power supplies with optional retry after a fault is detected. Faults that disable a power supply can automatically trigger black box EEPROM storage of fault status and associated telemetry. An internal 16-bit ADC monitors eight output voltages, one input voltage, and die temperature. In addition, odd numbered channels can be configured to measure the voltage across a current sense resistor. A programmable watchdog timer monitors microprocessor activity for a stalled condition and resets the microprocessor if necessary. A single wire bus synchronizes power supplies across multiple LTC power system management devices. Configuration EEPROM supports autonomous operation without additional software.

8-Channel PMBus Power System Manager



UP PACKAGE
64-LEAD (9mm × 9mm) PLASTIC QFN
LTC2978ACUP
LTC2978AIUP

Typical ADC Total Unadjusted Error vs Temperature



LTC3374

8-Channel Parallelable 1A Buck DC/DCs

FEATURES

- 8-Channel Independent Step-Down DC/DCs
- Master-Slave Configurable for Up to 4A per Output Rail with a Single Inductor
- Independent V_{IN} Supplies for Each DC/DC (2.25V to 5.5V)
- All DC/DCs Have 0.8V to V_{IN} Output Range
- Precision Enable Pin Thresholds for Autonomous Sequencing
- 1MHz to 3MHz Programmable/Synchronizable Oscillator Frequency (2MHz Default)
- Die Temperature Monitor Output
- Thermally Enhanced 38-Lead QFN (5mm × 7mm) and TSSOP Packages

APPLICATIONS

- General Purpose Multichannel Power Supplies
- Industrial/Automotive/Communications

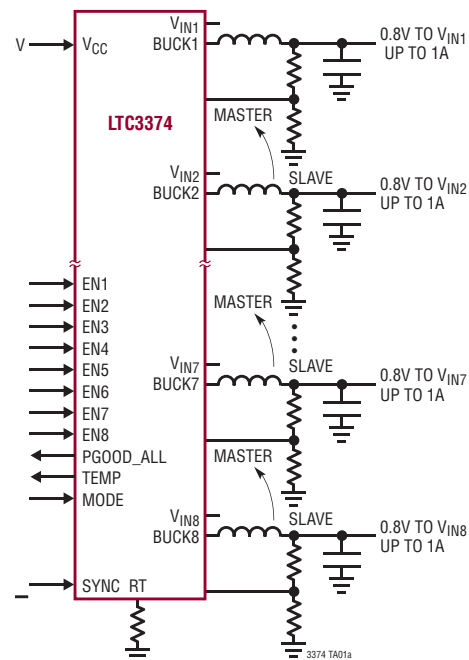
DESCRIPTION

The LTC3374 is a high efficiency multioutput power supply IC. The DC/DCs consist of eight synchronous buck converters (1A each) all powered from independent 2.25V to 5.5V input supplies.

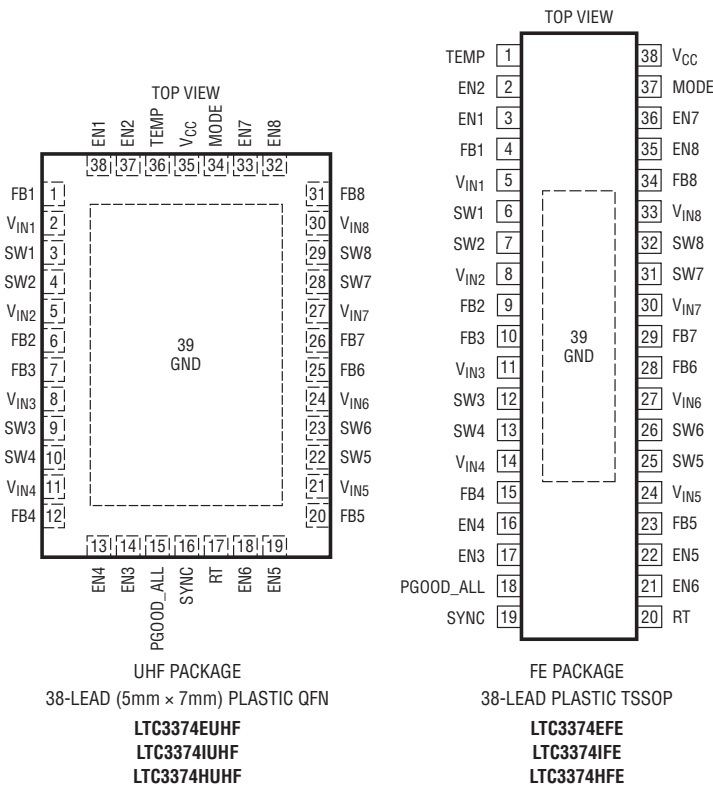
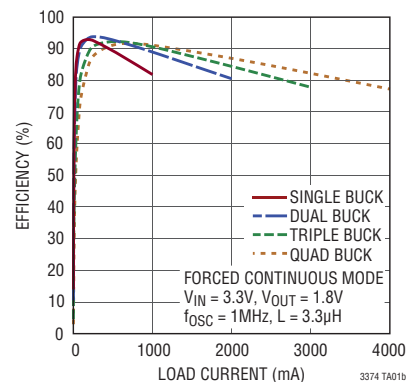
The DC/DCs may be used independently or in parallel to achieve higher currents of up to 4A per output with a shared inductor. The common buck switching frequency may be programmed with an external resistor, synchronized to an external oscillator, or set to a default internal 2MHz clock. The operating mode for all DC/DCs may be programmed via the MODE pin.

To reduce input noise the buck converters are phased in 90° steps. Precision enable pin thresholds provide reliable power-up sequencing. The LTC3374 is available in a compact 38-lead 5mm × 7mm QFN package as well as a 38-lead TSSOP package.

8-Channel 1A Multioutput Buck Regulator



Buck Efficiency vs I_{LOAD}



LT3574

Isolated Flyback Converter without an Opto-Coupler

FEATURES

- 3V to 40V Input Voltage Range
- 0.65A, 60V Integrated NPN Power Switch
- Boundary Mode Operation
- No Transformer Third Winding or Opto-Isolator Required for Regulation
- Improved Primary-Side Winding Feedback Load Regulation
- V_{OUT} Set with Two External Resistors
- BIAS Pin for Internal Bias Supply and Power NPN Driver
- Programmable Soft-Start
- Programmable Power Switch Current Limit
- 16-Lead MSOP Package

APPLICATIONS

- Industrial, Automotive and Medical Isolated Power Supplies

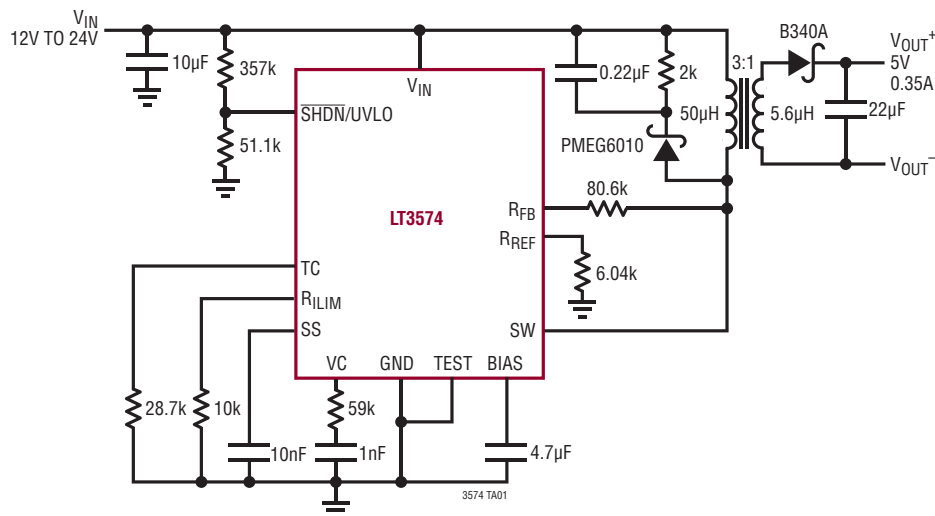
DESCRIPTION

The LT[®]3574 is a monolithic switching regulator specifically designed for the isolated flyback topology. No third winding or opto-isolator is required for regulation. The part senses the isolated output voltage directly from the primary side flyback waveform. A 0.65A, 60V NPN power switch is integrated along with all control logic into a 16-lead MSOP package.

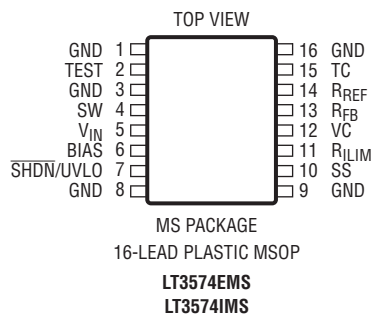
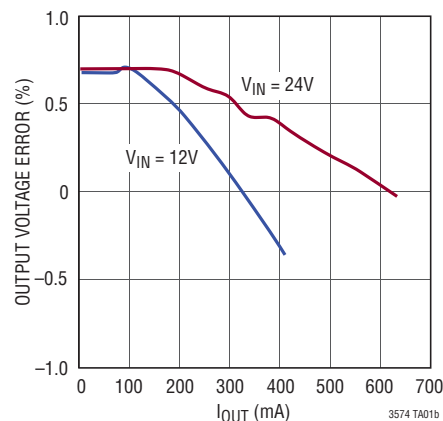
The LT3574 operates with input supply voltages from 3V to 40V, and can deliver output power up to 3W with no external power switch. The LT3574 utilizes boundary mode operation to provide a small magnetic solution with improved load regulation.

The output voltage is easily set with two external resistors and the transformer turns ratio. Off-the-shelf transformers are available for many applications.

5V Isolated Flyback Converter



Load Regulation



LTC3607

Dual 600mA 15V Monolithic Synchronous Step-Down DC/DC Regulator

FEATURES

- **High Efficiency: Up to 96%**
- **Very Low Quiescent Current: 55 μ A Total**
- **2.25MHz Constant Frequency Operation**
- **Low Dropout Operation: 100% Duty Cycle**
- **Low Ripple <30mV_{P-P} Burst Mode® Operation**
- Peak Current-Mode Control Architecture for Excellent Line and Load Transient Response
- Wide Voltage Input Range 4.5V to 15V
- 600mA/Channel Rated Output Current
- 0.6V Reference Allows Low Output Voltages
- $\pm 1.5\%$ Output Voltage Accuracy
- Ultralow Shutdown Current: $I_Q < 1\mu$ A
- Internal Compensation
- Power Good Outputs
- Externally Frequency Synchronization (1MHz to 4MHz)
- Independent Internal Soft-Start for Each Channel
- Small 16-Lead Thermally Enhanced Thin QFN (3mm $\times$ 3mm) and MSE Packages

APPLICATIONS

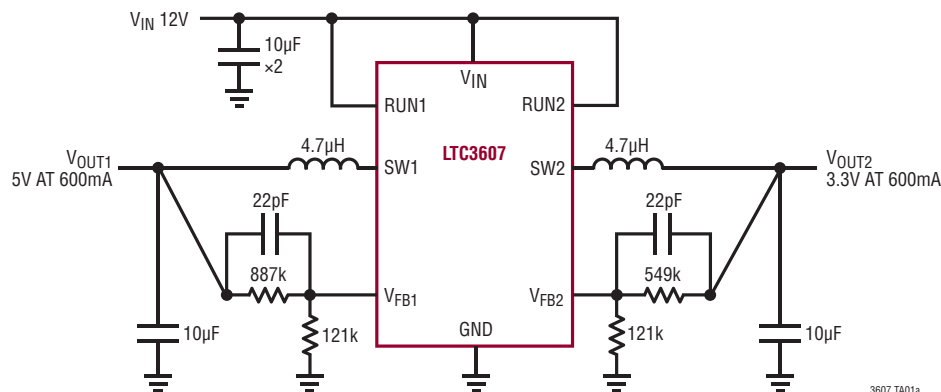
- Dual Lithium-Ion Battery Supplies
- Automotive Applications
- Servers

DESCRIPTION

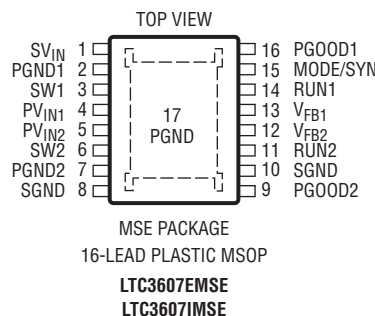
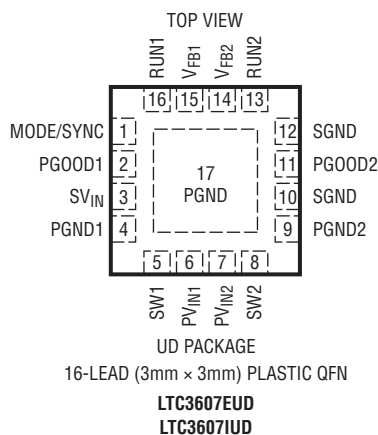
The LTC3607 is a 15V dual 600mA monolithic synchronous step-down regulator which has only 55 μ A quiescent current. Intended for a variety of applications, including dual lithium-ion battery products, it operates from a wide 4.5V to 15V input voltage range. It features a constant 2.25MHz switching frequency, enabling the use of tiny, low cost capacitors and inductors 1mm or less in height. Each output voltage is adjustable from 0.6V to V_{IN} . Internal synchronous power switches provide high efficiency without the need for external Schottky diodes.

A user selectable mode input is provided to allow the user to trade off ripple noise for light load efficiency; Burst Mode operation provides the highest efficiency at light loads, while pulse-skipping mode provides the lowest ripple noise.

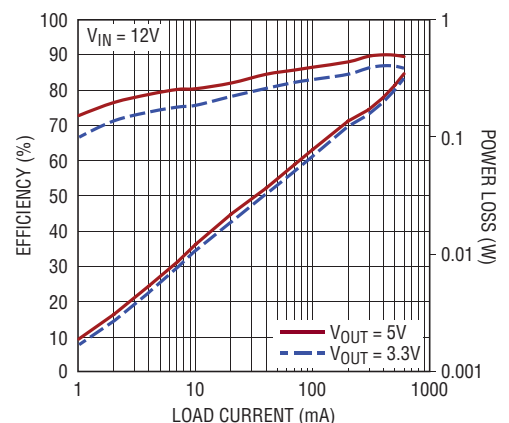
To further maximize battery run time, the P-channel MOSFETs are turned on continuously in dropout (100% duty cycle). In shutdown, the device draws <1 μ A.



3607 TA01a



Efficiency and Power Loss vs Load Current



LTC3630A

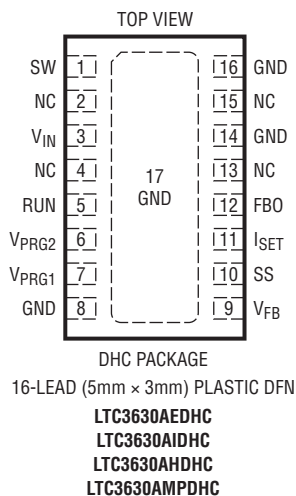
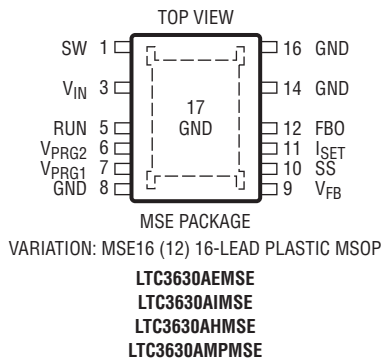
High Efficiency, 76V 500mA Synchronous Step-Down Converter

FEATURES

- Wide Operating Input Voltage Range: 4V to 76V
- Synchronous Operation for Highest Efficiency
- Internal High Side and Low Side Power MOSFETs
- No Compensation Required
- Adjustable 50mA to 500mA Maximum Output Current
- Low Dropout Operation: 100% Duty Cycle
- Low Quiescent Current: 12 μ A
- Wide Output Range: 0.8V to V_{IN}
- 0.8V $\pm$ 1% Feedback Voltage Reference
- Precise RUN Pin Threshold
- Internal and External Soft-Start
- Programmable 1.8V, 3.3V, 5V or Adjustable Output
- Few External Components Required
- Low Profile (0.75mm) 3mm $\times$ 5mm DFN and Thermally Enhanced MSE16 Packages

APPLICATIONS

- Industrial Control Supplies
- Medical Devices
- Portable Instruments
- Automotive
- Avionics



DESCRIPTION

The LTC[®]3630A is a high efficiency step-down DC/DC converter with internal high side and synchronous power switches that draws only 12 μ A typical DC supply current while maintaining a regulated output voltage at no load.

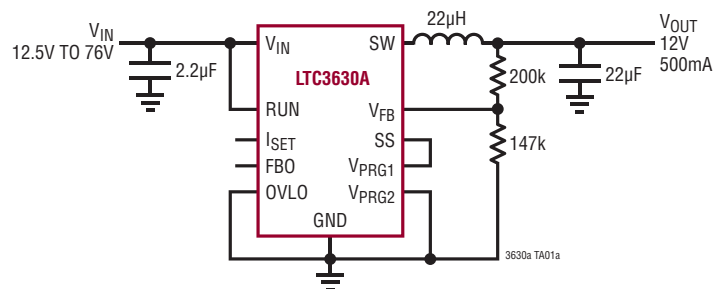
The LTC3630A can supply up to 500mA load current and features a programmable peak current limit that provides a simple method for optimizing efficiency and for reducing output ripple and component size. The LTC3630A's combination of Burst Mode[®] operation, integrated power switches, low quiescent current, and programmable peak current limit provides high efficiency over a broad range of load currents.

With its wide input range of 4V to 76V, the LTC3630A is a robust converter suited for regulating a wide variety of power sources. A feedback comparator output enables multiple LTC3630As to be paralleled in higher current applications.

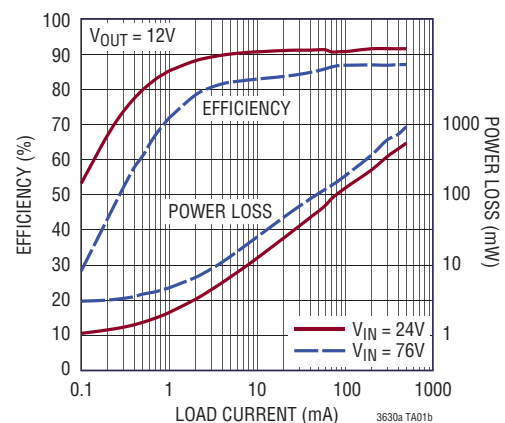
The LTC3630A is available in the thermally enhanced 3mm $\times$ 5mm DFN and the MSE16 packages.

PARAMETER	LTC3630A	LTC3630
Maximum Operating V_{IN}	76V	65V
Absolute Maximum V_{IN}	80V	70V

12.5V to 76V Input to 12V Output, 500mA Step-Down Converter



Efficiency and Power Loss vs Load Current



LT3995 60V, 3A, 2MHz Step-Down Switching Regulator with 2.7 μ A Quiescent Current

FEATURES

- **Ultralow Quiescent Current:**
2.7 μ A I_Q at 12V_{IN} to 3.3V_{OUT}
- **Low Ripple Burst Mode® Operation**
Output Ripple < 15mV_{p-p}
- **Wide Input Range: Operation from 4.3V to 60V**
- **3A Maximum Output Current**
- **Excellent Start-Up and Dropout Performance**
- **Adjustable Switching Frequency: 200kHz to 2MHz**
- **Synchronizable Between 250kHz to 2MHz**
- Accurate Programmable Undervoltage Lockout
- Low Shutdown Current: $I_Q = 700$ nA
- Power Good Flag
- Soft-Start Capability
- Thermal Shutdown Protection
- Current Limit Foldback with SS Override
- Saturating Switch Design: 85m Ω On Resistance
- Small, Thermally Enhanced 16-Lead MSOP Package

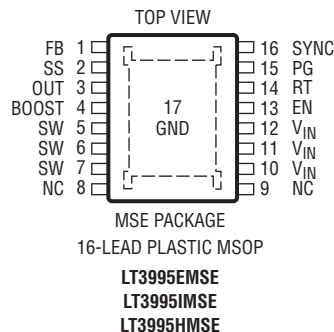
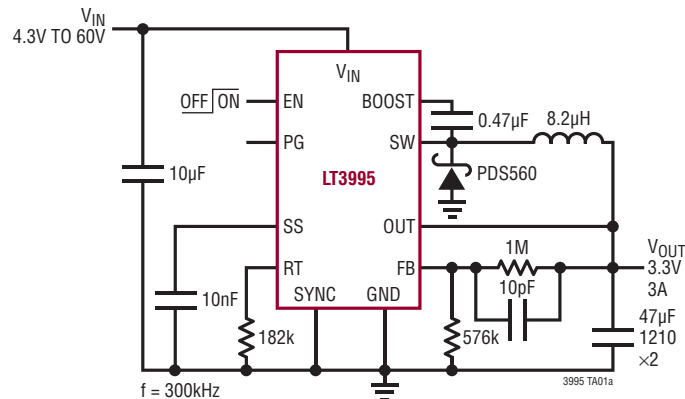
APPLICATIONS

- Automotive Battery Regulation
- Portable Products
- Industrial Supplies

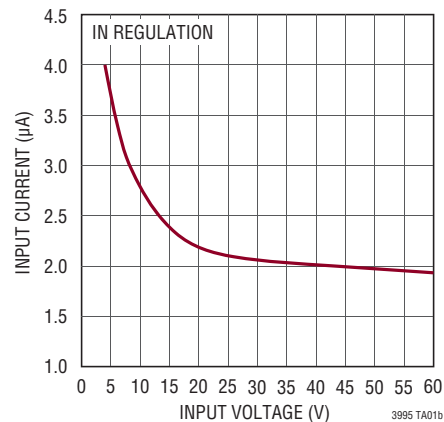
DESCRIPTION

The LT[®]3995 is an adjustable frequency monolithic buck switching regulator that accepts a wide input voltage range up to 60V. Low quiescent current design consumes only 2.7 μ A of supply current while regulating with no load. Low ripple Burst Mode operation maintains high efficiency at low output currents while keeping the output ripple below 15mV in a typical application. The LT3995 can supply up to 3A of load current and has current limit foldback to limit power dissipation during short-circuit. A low dropout voltage of 500mV is maintained when the input voltage drops below the programmed output voltage, such as during automotive cold crank. An internally compensated current mode topology is used for fast transient response and good loop stability. A high efficiency 85m Ω switch is included on the die along with a boost Schottky diode and the necessary oscillator, control, and logic circuitry. An accurate 1.02V threshold enable pin can be driven directly from a microcontroller or used as a programmable undervoltage lockout. A capacitor on the SS pin provides a controlled inrush current (soft-start). A power good flag signals when V_{OUT} reaches 91.6% of the programmed output voltage. The LT3995 is available in a small 16-lead MSOP package with exposed pad for low thermal resistance.

3.3V Step-Down Converter



No-Load Supply Current



LT8697

USB 5V 2.5A Output, 42V Input Synchronous Buck with Cable Drop Compensation

FEATURES

- **Wide Input Range: 5V to 42V**
- **Low Dropout Under All Conditions: 450mV at 2.1A**
- **Accurate 5V Output: $\pm 1.3\%$ Over Full Temperature Range**
- **Programmable Cable Drop Compensation**
- **Programmable Output Current Limit**
- **Output Current Monitor**
- **Dual Input Feedback Permits Regulation on Output of USB Switch**
- **Forced Continuous Mode for Fast Load Step Response**
- High Efficiency Synchronous Operation at 2MHz:
 - 93% Efficiency at 2.1A, $5V_{OUT}$ from $12V_{IN}$
 - 95% Efficiency at 0.9A, $5V_{OUT}$ from $12V_{IN}$
- Fast Minimum Switch-On Time: 70ns
- Adjustable Output from 5.0V to 5.25V
- Adjustable and Synchronizable: 300kHz to 2.2MHz
- Small Thermally Enhanced 3mm $\times$ 5mm 24-Lead QFN Package

APPLICATIONS

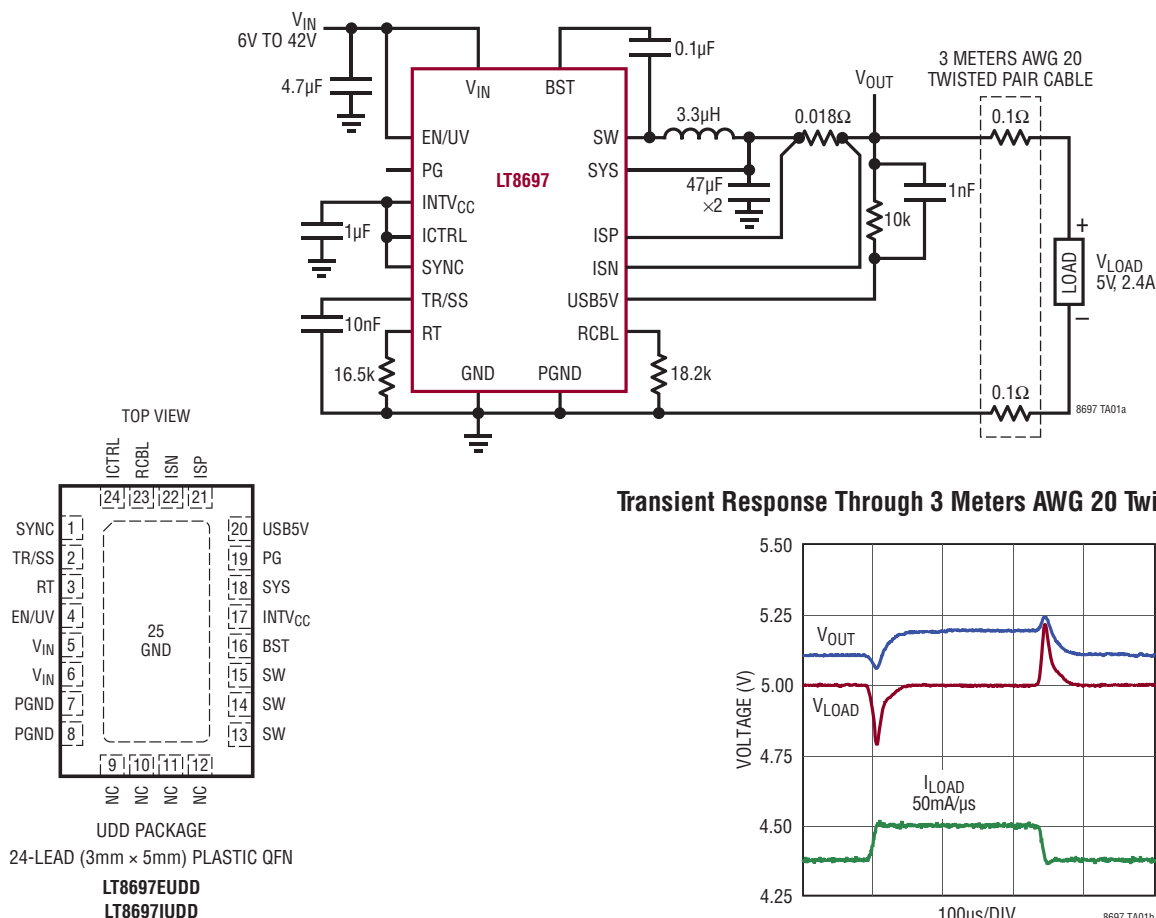
- Automotive and Industrial USB
- Precision 5V Supply

DESCRIPTION

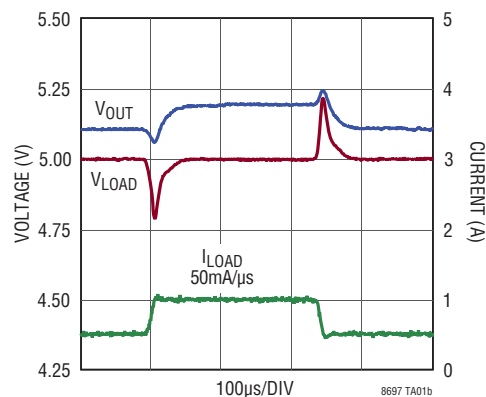
The LT[®]8697 is a compact, high efficiency, high speed synchronous monolithic step-down switching regulator designed to power 5V USB applications. A precise output voltage and programmable cable drop compensation maintain accurate 5V regulation at the USB socket at the end of a long cable. Forced continuous operation allows the LT8697 to sink current, further enhancing accurate 5V regulation during load transients.

Accurate and programmable output current limit, a power good indicator pin and an output current monitor pin improve system reliability and safety, allow the user to implement latch-off or auto-retry functionality and can eliminate the need for a USB switch IC. Dual feedback allows regulation on the output of a USB switch and limits cable drop compensation to a maximum of 5.8V output, protecting USB devices during fault conditions. Thermal shutdown provides additional protection by limiting power dissipation in the IC during an overtemperature fault. The LT8697 is available in a small 24-lead 3mm $\times$ 5mm package with an exposed pad for low thermal resistance.

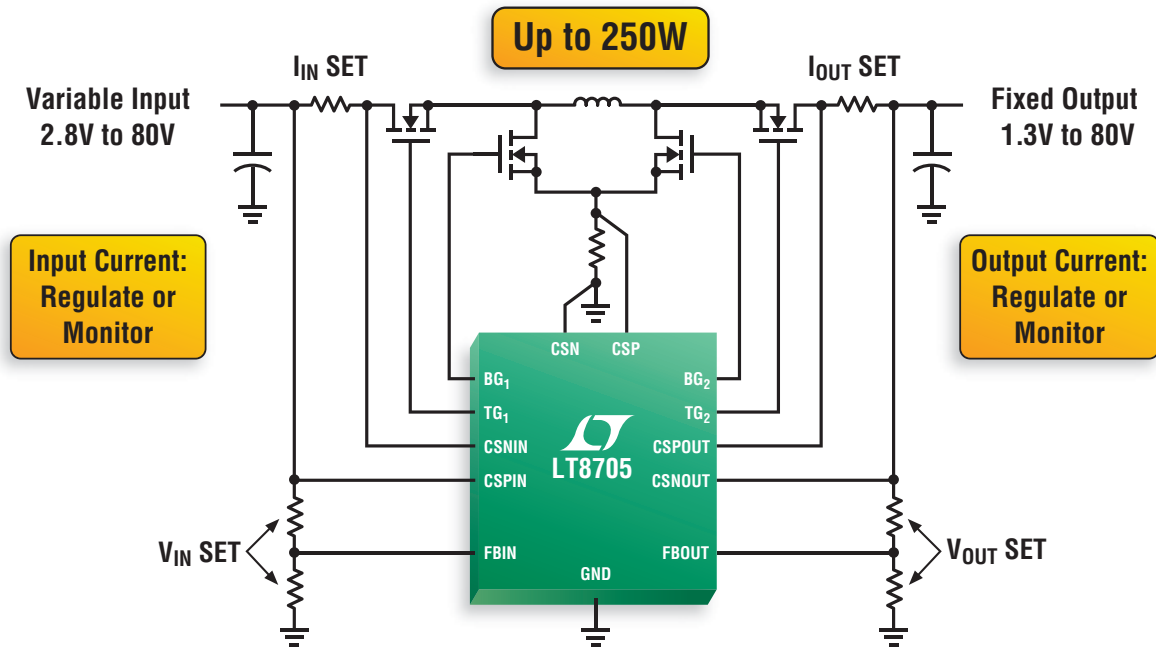
2MHz 5V Step-Down Converter with Cable Drop Compensation



Transient Response Through 3 Meters AWG 20 Twisted-Pair Cable



80V Sync Buck-Boost



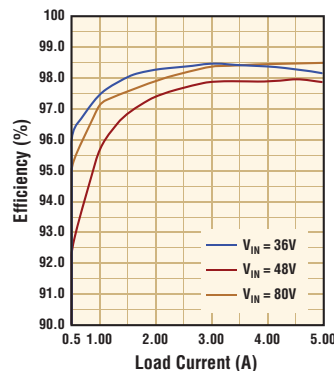
Four Regulation Loops (V_{OUT} , I_{OUT} , V_{IN} and I_{IN})

The LT[®]8705 is the latest in our growing family of single inductor buck-boost controllers. This wide input voltage range, high power controller is capable of delivering efficiencies up to 98.5% for a 48V, 5A output from an input voltage range of 2.8V to 80V. Using a single inductor and 4 external MOSFETs, the LT8705 can deliver output power up to 250W. Input or output voltage or current, any of these can be regulated with the devices' 4 control loops. Its input regulation loop is ideal for high impedance sources such as solar panels.

▼ Features

- Single Inductor
- Very High Efficiency
- V_{IN} Range: 2.8V to 80V
- V_{OUT} Range: 1.3V to 80V
- V_{OUT} , I_{OUT} , V_{IN} , I_{IN} Feedback Loops
- Current Monitors
- Synchronous Rectification
- Quad N-Channel MOSFET Gate Drivers
- Solar-Powered Battery Charger Capable

36V to 80V Input; 48V, 5A Output



▼ Info & Free Samples

www.linear.com/product/LT8705

1-800-4-LINEAR



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LTC3774

Dual, Multiphase Current Mode Synchronous Controller for Sub-Milliohm DCR Sensing

FEATURES

- Sub-Milliohm DCR Current Sensing
- Operates with Power Blocks, DRMos or External Gate Drivers and MOSFETs
- Supports Phase Shedding and N+1 Phase Redundancy
- Programmable DCR Temperature Compensation
- $\pm 0.75\%$ Maximum Total DC Output Error
- Dual Differential Remote Output Voltage Sense Amplifiers
- Phase-Lockable Fixed Frequency Range: 200kHz to 1.2MHz
- V_{IN} Range: 4.5V to 38V
- V_{OUT} Range: 0.6V to 3.5V
- Supports Smooth Start-Up into Prebiased Outputs
- Programmable Soft-Start or V_{OUT} Tracking
- Hiccup Mode/Soft Recovery from Output Overcurrent
- 36-Lead (5mm $\times$ 6mm) QFN Package

APPLICATIONS

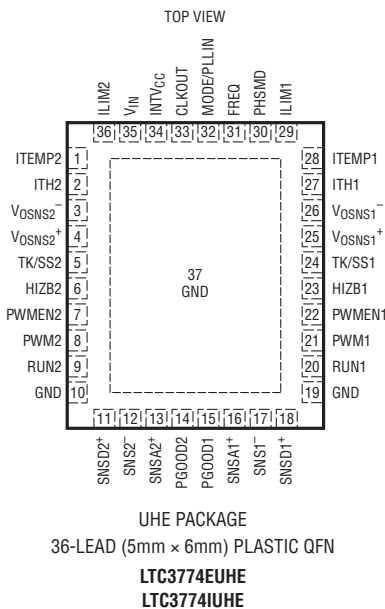
- Computer Systems
- Telecom and Datacom Systems
- Industrial Equipment
- DC Power Distribution Systems

DESCRIPTION

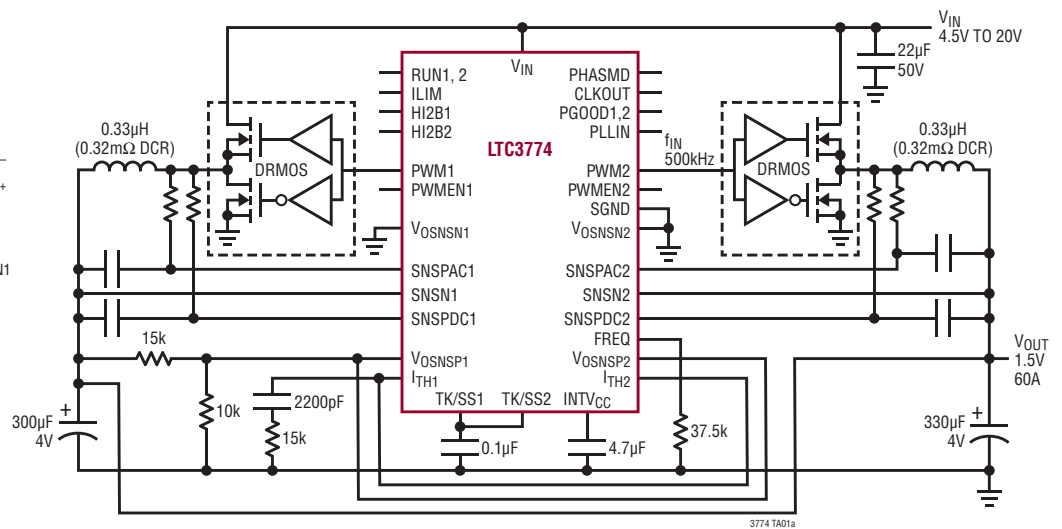
The LTC[®]3774 is a dual PolyPhase[®] current mode synchronous step-down switching regulator controller that drives power blocks, DRMos or external gate drivers and FETs. It offers a Linear Technology proprietary technique that enhances the signal-to-noise ratio of the current sense signal, allowing the use of inductors with very low DC winding resistances as the current sense element for maximum efficiency and reduced jitter.

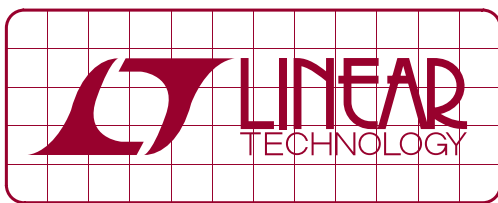
The maximum current sense voltage is programmable from 10mV to 30mV. High speed low offset remote sense differential amplifiers and a precise 0.6V reference provide accurate output voltages between 0.6V and 3.5V from a wide 4.5V to 38V input supply range. Soft recovery from output shorts or overcurrent minimizes output overshoot. Burst Mode[®] operation, continuous and pulse-skipping modes are supported. The constant operating frequency can be synchronized to an external clock or linearly programmed from 200kHz to 1.2MHz. Up to six LTC3774 controllers can be paralleled for 1-, 2-, 3-, 4-, 6-, 8- or 12-phase operation.

The LTC3774 is available in a 36-lead (5mm $\times$ 6mm) QFN package.



High Efficiency Dual Phase 1.5V/60A Step-Down Converter





DESIGN NOTES

1 μ A I_Q Synchronous Boost Converter Extends Battery Life in Portable Devices

Design Note 516

Goran Perica

Introduction

Boost converters are regularly used in portable devices to produce higher output voltages from lower battery input voltages. Common battery configurations include two to three alkaline or NiMH cells or, increasingly, Li-Ion batteries, yielding a typical input voltage between 1.8V and 4.8V.

The 12V output converter shown in Figure 1 is designed to run from any typical small battery power source. This design centers around the **LTC3122** boost converter, which can efficiently generate a regulated output up to 15V from a 1.8V to 5.5V input. The LTC3122 includes a 2.5A internal switch current limit and a full complement of features to handle demanding boost applications, including switching frequency programming, undervoltage lockout, Burst Mode[®] operation or continuous switching mode, and true output disconnect. The integrated synchronous rectifier is turned off when the inductor current approaches zero, preventing reverse inductor current and minimizing power loss at light loads.

This unique output disconnect feature is especially important in applications that have long periods of idle time. While idling, the part can be shut down, leaving the output capacitor fully charged and standing by for quick turn-on. In shutdown, the part draws less than 1 μ A from the input source.

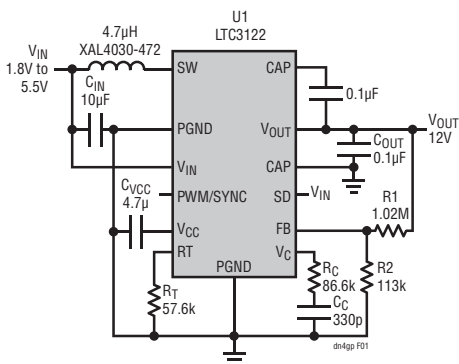


Figure 1. The 1MHz Operating Frequency and Small Inductor Make This Converter Suitable for Demanding Portable Battery-Powered Applications.

Because the batteries used in portable devices are usually as small as possible, they present high internal impedance under heavy loads, especially close to the end of their discharge cycle. Unlike other boost converters that struggle with high source impedance at startup, the LTC3122 prevents high surge currents at startup.

1.8V to 5.5V Input to 12V Output Boost Regulator

The circuit in Figure 1 is designed for high efficiency and small size. The LTC3122 operates at 1MHz to minimize the size of the filter capacitors and boost inductor, and uses Burst Mode operation to maintain high efficiency at light loads, as shown in Figure 2. At heavier loads, the converter can operate in constant frequency mode, resulting in lower input and output ripple. Constant frequency operation can result in lower EMI and is easier to filter.

Efficiency can be increased by running the LTC3122 at a relatively low switching frequency. Figure 3 shows the results of reducing the switching frequency from 1MHz to 500kHz.

Efficiency can be improved further by increasing the inductor size. Figure 4 shows the increase in efficiency

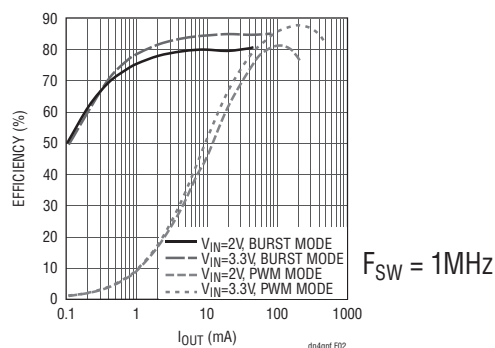


Figure 2. The High Efficiency of the LTC3122 Boost Converter Extends Battery Life in Portable Applications.

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achieved by replacing the 4mm × 4mm boost inductor (XAL4030-472) with a 7mm × 7mm inductor (744-777-910 from Würth). The 90% efficiency at 10mA is 5% higher than the efficiency shown in Figure 3.

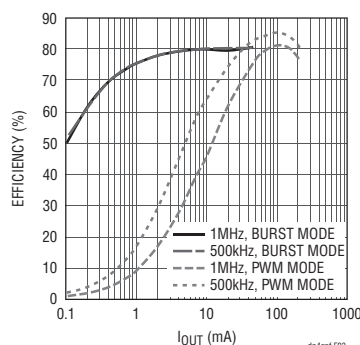


Figure 3. The Efficiency is Greatly Affected by the Operating Frequency. At 100mA Load an Additional 4% Can Be Gained by Reducing the Switching Frequency from 1MHz to 500kHz.

Battery size should be taken into account when considering inductor size. Using a relatively small inductor running at a high frequency may necessitate a correspondingly higher capacity battery to achieve the same run time at relatively lower efficiency. In other words, space gains achieved with a smaller inductor may be replaced by the need for a bigger battery.

Output Disconnect

Typical boost converters cannot disconnect the output from the input because of the boost diode. Current always flows from the input through the inductor and boost diode to the output. Therefore the output can not be shorted or disconnected from the input, a significant problem in many applications, especially in shutdown. In contrast, the LTC3122 includes an internal switch that disconnects the boost MOSFET body diode from the output. This also allows for inrush current limiting at turn-on, minimizing the surge currents seen by the input power source.

Figure 5 shows the output of the LTC3122 disconnected in shutdown. The output voltage is pulled to zero by the load following shutdown, and the LTC3122 consumes less than 1μA of current.

Start-Up Inrush Current Limiting

To simulate a real battery-operated application, the circuit in Figure 1 was tested with 1Ω of equivalent series resistance (ESR) placed between the power source and the LTC3122 circuit. Once the LTC3122 is enabled, it controls the startup so that the input power

source can lift the output rail to regulation. The input current slowly ramps up. The input current overshoot required to charge the output capacitor is limited to only 200mA and the input power source voltage droop is limited to 0.5V, as shown in Figure 5.

Conclusion

The LTC3122 boost converter serves the needs of battery-operated applications that require low standby quiescent current and high efficiency. Unlike many other boost converters, it includes features, enabling operation from batteries near full discharge when battery ESR becomes high. Its very low quiescent and shutdown currents, combined with output disconnect, extend battery run time in applications with long idle periods. The LTC3122 includes a complete set of features for high performance battery operated applications and comes in a small, thermally enhanced 3mm × 4mm package.

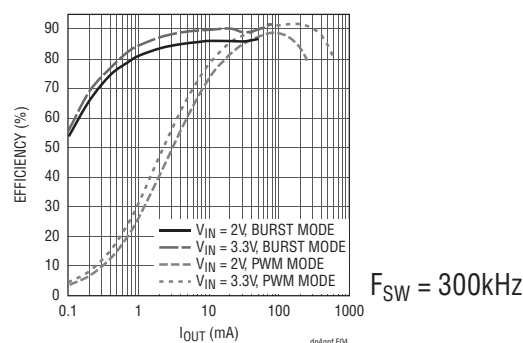


Figure 4. With a Lower Switching Frequency and a Larger Inductor, a Smaller Battery Can Be Used. Efficiency Gain Up to 30% in the 1mA to 10mA Load Range (in PWM Mode) Can Significantly Improve Applications That Operate with Light Loads.

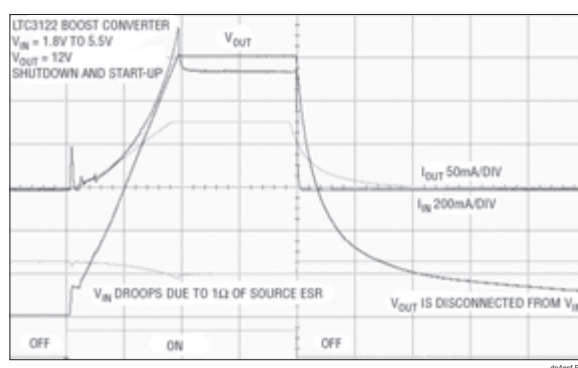


Figure 5. Inrush Current Limiting at Turn-On Minimizes Surge Currents Seen by the Input Source. The Output Is Disconnected from Input During Shutdown.

Data Sheet Download

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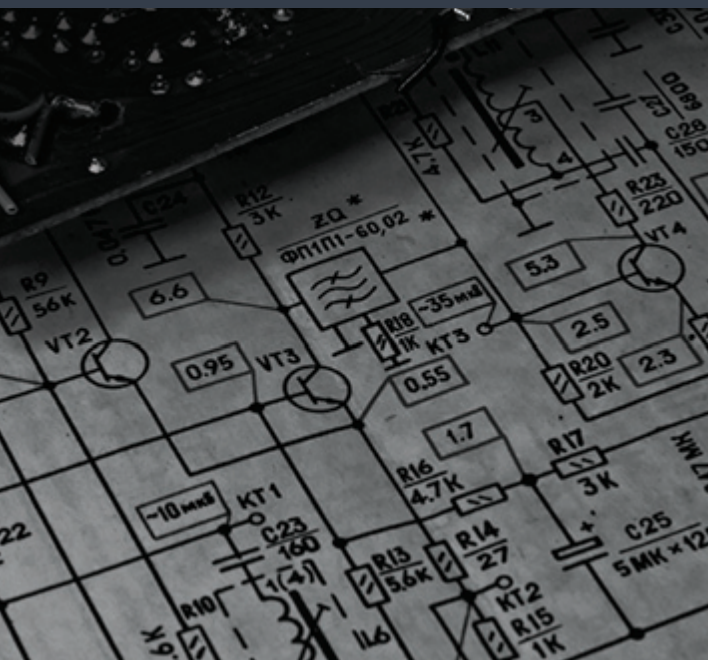
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